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REPORT OF THE THIRTY-SIXTH ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE

The Thirty-sixth Annual Meeting of the Ohio Academy of Science was held at the Ohio State University, Columbus, Ohio, April 9 and 10, under the presidency of Dr. Paul M. Rea. About one hundred fifty members, old and new, were in attendance. Sixty-nine new members were elected, thus bringing the total membership of the Academy up to 442 at the close of the meeting.

The following is the general program of the meeting:

FRIDAY, APRIL 9.

9:00 A. M.—Business meeting.

10:00 A. M.—Reading of papers in general session.

1:00 P. M.—Reading of papers in sectional meetings.

4:00 P. M.—Invitation address on "The Evolution of the Grand Canyon Region," by Dr. Douglas Johnson, of Columbia University, New York City.

6:30 P. M.—Annual banquet at the New Neil House.

8:00 P. M.—The Presidential Address on "The Social Significance of Science," by President Rea.

SATURDAY, APRIL 10.

8:00 A. M.—Adjourned business meeting.

9:00 A. M.—Reading of papers in general session, including two very interesting symposia, one on "Animal Parasitism" and the other on "Biological Training for Medicine and Dentistry."

Minutes of the Business Meetings.

The first business session was called to order by President Rea at 9:05 A. M., Friday, April 9, 1926, in the Auditorium of the Archaeological Museum.

The President announced the appointment of the following committees:

Committee on Membership—M. E. Stickney, W. M. Barrows, J. Ernest Carman.

Committee on Resolutions—Edward L. Rice, F. C. Waite, E. L. Moseley.

Committee on Necrology—Henry C. Beardslee, Herbert Osborn.

The following *Auditing Committee* was then elected by the Academy: Raymond C. Osburn, David Dietz.

The following *Nominating Committee* was elected by ballot by the Academy: Herbert Osborn, M. E. Stickney, J. Ernest Carman, F. C. Waite, H. E. Burtt, and F. C. Blake.

The reports of the following officers and standing committees were called for, read and ordered filed, viz.: The Secretary, the Treasurer, the Executive Committee, the Publications Committee, the Trustees of the Research Fund, the Library Committee and the Committee on State Parks and Conservation.

At an adjourned meeting held in Room No. 100, Botany and Zoology Building, 8:00 A. M., Saturday, April 10, the reports of the special committees, namely, the Committee on Membership, on Resolutions, on Necrology, on Legislation, on Auditing, and on Nominations, were read, approved and ordered filed. The reports of all committees, standing and special, together with the officers' reports, are published in full below.

Under the head of new business, Dr. Edward L. Rice requested the prompt and cordial co-operation of the members of the Academy in bringing to his attention all instances of adverse or unfriendly legislation, actual or proposed, regarding the teaching of science in the public schools and educational institutions of the country. Doctor Rice is the official representative of the Ohio Academy of Science in the American Association for the Advancement of Science in matters along the line of his request.

The business meeting was adjourned at 8:58 a. m.

Reports.

Report of the Secretary.

Columbus, Ohio, April 9, 1926.

To the Ohio Academy of Science:

Passing the year now ending in hasty review, omitting of course the numerous details that engage the time and attention of the Secretary in the course of the year, we note that the first event of more than passing interest and importance was the holding of memorial exercises in University Hall, Ohio State University, in honor of the late Thomas Corwin Mendenhall, a distinguished member of this Academy, on the afternoon of April 16, 1925. The following was the brief, simple program:

PROGRAM.

Dr. William Oxley Thompson, *Presiding.*

Address by Dr. Ira N. Hollis, President of Worcester Polytechnic Institute, Worcester, Mass.

Address by Dr. Charles Frederick Marvin, Chief, U. S. Weather Bureau, Washington, D. C.

Personal Reminiscences from Dr. Elihu Thompson, Director of the Thompson Laboratory, General Electric Company, Lynn, Mass.

Presentation by the Mendenhall family of a bronze replica of the portrait medallion of Dr. Mendenhall given him by his first group of students on the fiftieth anniversary of the opening of the University, September 17, 1923.

The following account of these exercises was prepared by Dr. A. D. Cole, of the Ohio State University, who served as the chairman of the committee that arranged the memorial services:

"On April 16, 1925, the trustees of the Ohio State University held memorial exercises in honor of Thomas Corwin Mendenhall, the first professor of physics of the University and since 1919 a member of the Board of Trustees. President William Oxley Thompson presided at these exercises. The program included an address by Dr. Ira N. Hollis, President of Worcester Polytechnic Institute, and an address by Dr. Charles Frederick Marvin, Chief of the U. S. Weather Bureau, Washington, D. C. Personal reminiscences by Dr. Elihu Thompson, Director of the Research Laboratory, General Electric Co., and by Dr. Edward S. Morse, President of the Lynn, Mass., Peabody Academy of Science, Salem, Mass., were read.

Dr. Hollis spoke of Dr. Mendenhall's service to the Worcester Polytechnic Institute as its president from 1894–1901, which included the successful establishment of important changes in its educational policy. He emphasized Dr. Mendenhall's fine spirit of co-operation with other forward-looking men as effective in the accomplishing of needed reforms.

Dr. Marvin spoke sympathetically of Dr. Mendenhall's early work in organizing the scientific work of the then new Ohio State University and interesting the Columbus public in all the important scientific discoveries of the time. Dr. Marvin also showed how his effectiveness as a scientist

was greater because "he acted and moved in an atmosphere of warm human affection, sympathy, good fellowship and sunshine." An interesting personal touch was added when he told of his own experiences as assistant to Dr. Mendenhall in experiments for the Lowell lectures of 1882 in Boston and in organizing the research work of the Signal Corps of the U. S. Army at Washington a little later. He gave an interesting account of Dr. Mendenhall's important improvements in the accurate measurements of length and time which form an important part of the work of the U. S. Coast and Geodetic Survey, of which he was Superintendent from 1889 to 1894.

Dr. Elihu Thompson told how Dr. Mendenhall had conducted the first efficiency tests of commercial electric lighting ever made in this country (at Cincinnati in 1883), also of his important activities in the International Electrical Congress in 1893, which adopted definitions for the ampere, volt and other electrical units.

Dr. Edward S. Morse confined his memories largely to their joint labors as professors in the Imperial University of Japan, where they were very intimately associated and very close friends. He gave a fine tribute to Dr. Mendenhall as a teacher and scientist, with special emphasis upon his extraordinary personal charm.

President Thompson made two interesting announcements. The first that the Trustees of the University had named the large Physics Building the Mendenhall Laboratory in recognition of his important services to the institution, both as professor of physics for many years and as a member and chairman of its Board of Trustees. The second announcement was that his son, Professor Charles E. Mendenhall, of the University of Wisconsin, had given to the University a replica of the beautiful bronze medallion portrait of Dr. Mendenhall which was presented to him by the surviving members of that first group of seventeen students, on the 50th anniversary of their enrollment when the University opened its doors in September, 1873.

Professor Charles Mendenhall was present with his wife and son. They and the two principal speakers were later guests of the Faculty Club at a banquet given to them and the University Trustees in the Club dining room."

Certificates of election to fellowship in the Academy were sent to all those elected at the Wooster meeting, on April 3, 1925.

A brief report of the Thirty-fifth Annual Meeting of the Academy was prepared and sent to *Science*, and was published in that journal of July 17, 1925, pages 60–62, (Vol. LXII, No. 1594, New Series).

The Secretary represented the Academy in the Council of the American Association for the Advancement of Science at the Kansas City meeting, December 29, 1925, to January 3, 1926. Perhaps attention should again be called to the fact that the Council of the A. A. A. S. at the Kansas City meeting passed a special ruling by which any member of an affiliated society or academy may join the Association without the payment of the usual $5.00 entrance fee. It was also noted with considerable pride and pleasure that one of if not the outstanding address of the meeting was made by one of our own members, namely, Dr. Dayton C. Miller, of the Case School of Applied Sciences, Cleveland,

Ohio. Doctor Miller gave that great gathering of scientists an unusual thrill when he announced that as a result of more than one hundred thousand separate readings or observations on ether drift, performed under the most trying circumstances in 1925, that it has been determined in effect that the earth does drag the ether so that the apparent relative motion at the point of observation is one-twentieth of the absolute motion and that the earth and the whole solar system are rushing headlong into the dragon of the sky, the constellation Draco, at the immense speed of at least 125 miles per second, perhaps faster!

On March 19, 1926, the Secretary received a telegraphic request from Watson Davis, editor, *Science Service*, for copies or abstracts of the papers to be presented at this meeting in order to send out some ten days in advance of the meeting news stories regarding the principal papers to be read. This request could not be complied with, as copies and abstracts were not available. Given as a hint for the future!

Respectfully submitted,

WM. H. ALEXANDER, *Secretary.*

Report of the Treasurer for the Year 1925–1926.

The following report from the Treasurer was received and referred to the Auditing Committee for examination. The report of the Auditing Committee is appended.

To the Ohio Academy of Science:

Your Treasurer submits the following report for the period from March 13, 1925, to April 1, 1926, inclusive:

RECEIPTS.

Cash balance as of March 13, 1925	$ 961.01
Interest total on certificate of deposit payable in two checks of April and October	39.00
Library sales of publications	37.74
Received from Secretary A. A. A. S. allowance of fifty cents per member of the A. A. A. S. on 207 members, 1926 collections to date	103.50
From Academy members' accounts to date	592.20
Total Receipts—Exhibit A	$1,733.45

DISBURSEMENTS.

To Wm. H. Alexander, Secretary's honorarium	$ 100.00
To The Ohio Journal of Science for 1925 subscriptions	372.00
To Postmaster, Columbus Post Office, for stamped envelopes	21.92
To Postmaster, Columbus Post Office, for stamps	10.00
To A. E. Kraus Print Shop	79.75
To Hiss Stamp Company	.80
To Helen Coleman, stenographic assistance	8.00
To Wm. H. Alexander, secretarial expenses	14.54
To B. E. Livingston, forwarded dues	6.00
To check returned—account closed	2.00
To R. A. Hefner, check for incorrect payment A. A. A. S. dues	4.00
To Wm. H. Alexander, secretarial expenses	2.36
To the Ohio Journal of Science for 1926 subscriptions	396.00
Total Disbursements—Exhibit B	$1,017.37

BALANCE SHEET.

Exhibit A—Receipts	$1,733.45
Exhibit B—Disbursements	1,017.37
Cash balance on hand April 1, 1926	$ 716.08

Estimated current liabilities including expenses of the meeting and printing and the 1926 Secretary's honorarium would amount to approximately three hundred dollars, leaving an available surplus of approximately four hundred dollars.

Respectfully submitted,

A. E. WALLER, *Treasurer.*

Report of the Auditing Committee.

COLUMBUS, OHIO, April 10, 1926.

The Auditing Committee of the Ohio Academy of Science at its Annual Meeting, April 10, 1926, has examined the books of the Treasurer of the Academy and of the Trustees of the Research Fund of the Academy and find them to be correct.

(Signed) RAYMOND C. OSBURN,
DAVID DIETZ,
Auditing Committee.

Report of the Executive Committee.

COLUMBUS, OHIO, April 9, 1926.

To the Ohio Academy of Science:

Pursuant to a call of the President, the Executive Committee met at the office of the Secretary, 16 East Broad Street, Columbus, January 9, 1926, with all members present and in addition Dr. C. H. Kennedy, Vice-President of the Zoology Section. President Rea called the meeting to order at 2:10 p. m., and after a brief statement by the President of the purpose of the meeting and a short general report by the Secretary as to routine matters during the year, the following motions were made and agreed to, viz:

That the Academy be asked at its next annual meeting to pass a resolution authorizing the Executive Committee, in worthy cases and at its own discretion, to relieve members of 20 years' or more standing of further payment of dues.

That a letter be written by the Secretary to Mr. Otto H. Swezey expressing the regrets of this Committee that he has severed his connection with the Academy.

That the Secretary prepare the draft of a revision of Article III, Membership, of the Constitution so as to eliminate the class of members known as "Corresponding Members" and present same at the next annual meeting of the Academy.

That the Treasurer be requested to secure from the Librarian of the Ohio State University an inventory of all Academy publications now on hand and, if possible, make some definite agreement as to the sale and distribution of same.

That the Vice-Presidents of the several sections be the accredited representatives of the sections to the A. A. A. S. and in the event the Vice-President of a section cannot attend, he appoint a representative.

That the next annual meeting of the Academy be held at the Ohio State University, Columbus, as per standing invitation, on April 9 and 10, 1926.

The applications for membership in the Academy of Mr. Warren C. Miller, Bedford, Ohio, and Mr. Francis J. Pettijohn, Oberlin, Ohio, were favorably acted upon, subject to ratification by the Academy.

A second meeting of the committee was held last evening at the office of the Secretary, at which the following items of business were agreed upon, viz:

That the Publications Committee be requested to arrange for the printing of a revised list of the publications of the Academy, that 500 reprints of said list be made for the use of the Library Committee, and that the advisability of reprinting some of the older publications, the supply of which has become exhausted, be taken up.

That the Academy be asked to send its Treasurer, Dr. A. E. Waller, as the official representative to the International Botanical Congress to assemble at Ithaca, N. Y., in August, 1926, and that the Academy pay his actual transportation expenses to and from the meeting.

That the applications of the 51 persons for membership in the Academy, presented by the Secretary, be approved subject to ratification by the Academy.

Dr. Frederick H. Krecker, editor of THE OHIO JOURNAL OF SCIENCE, came before the committee and made a full frank statement regarding the OHIO JOURNAL OF SCIENCE—its financial needs, desired improvements, policies, changes, actual and proposed, etc. In line with the suggestions of Doctor Krecker it was voted unanimously to recommend to the Academy that the retiring President and the President be made the representatives of the Academy on the Editorial Board of the Journal and that the Academy express its entire approval of the efforts and plans of the Editorial Board to improve the Journal and pledge its support in any proper effort to secure additional financial support. To this end, the Committee suggests that the Executive Committee for the ensuing year be requested to consider fully the whole matter and if thought advisable, recommend some plan by which the Academy may extend additional financial support to the JOURNAL.

Respectfully submitted,

WM. H. ALEXANDER, *Secretary.*

Proposed Amendment of the Constitution.

(By the Executive Committee).

That ARTICLE III—*Membership,* be amended to read as follows:

ARTICLE III.—MEMBERSHIP.

1. *Classes of Members.*—The Academy shall be composed of members, fellows, honorary members and patrons.
2. *Members.*—Members shall be persons interested in scientific work.
3. *Fellows.*—Fellows shall be persons who are engaged in productive scientific work.
4. *Honorary Members.*—Honorary members shall be persons distinguished for their attainments in science and not resident of the State of Ohio. Their number shall not exceed twenty-five.
5. *Patrons.*—Patrons shall be persons who have bestowed important favors upon the Academy as defined in the By-Laws.
6. *Privileges of Members.*—Only members, fellows and patrons shall be entitled to vote in the Academy; only fellows and patrons shall be eligible to office and to membership in the Executive Committee.

And further, that such other verbal changes as may be necessary to make the Constitution and the By-Laws consistent with the foregoing be made.

Report of the Trustees of the Research Fund.

The Trustees of the Research Fund, in presenting a financial statement of the condition of the funds in hand, desire to call attention to the action at our last meeting authorizing the allotment of funds in assistance of scientific investigations and the use of the income from $1,000 of invested funds to be known as the McMillin Grant, in recognition of an exceptional contribution to science by a member of the Academy. The Trustees have not received any nominations for such an award this year, but will be pleased to have nominations during the coming year.

A request for an allowance to aid in the publication of a paper by Dr. W. M. Barrows was granted.

The balance on hand at the time of the report of a year ago was $1,362.91, of which $1,300 was invested in bonds and the interest added during the year, $91, giving a total of $1,453.91, less the grant to Dr. Barrows of $70, gives a present total of $1,383.91, or a cash balance of $83.91 above the $1,300.00 invested. Interest accruing April 15th will give an available balance of $127.41 for grants during the coming half year without drawing upon the invested fund. An additional $45.50 will be due October 15th.

Unless it is the wish of the Academy that the fund be allowed to accumulate, we will be pleased to receive requests for the use of the available balance, although it is obvious that no large sums can be allotted. Vouchers, bank statement and receipt for bonds deposited will be furnished the auditing committee.

Respectfully submitted,

HERBERT OSBORN, *Chairman,*
EDWARD L. RICE,
GEO. D. HUBBARD,
Trustees.

Columbus, Ohio, April 10, 1926.

Report of Committee on State Parks and Conservation.

A meeting was held at the Neil House, Columbus, evening of April 8th, 1926, and the committee begs to report progress and certain recommendations for consideration.

According to statements of State Forester, Mr. Secrest, there have been additions to the state forests which bring the total to 19,826 acres, at an average cost of $6.10 per acre, and further additions are being made so that progress in this field is encouraging.

Recent legislation concerning sanitary regulations for state parks as set forth in bulletins and leaflets from the State Department of Health have provided for the control of parks in this respect in a very efficient manner. A general and whole-hearted compliance with these regulations will ensure healthful conditions for all those who use the parks.

A start has been made in the organization of an advisory Council on State Parks and Conservation by the calling of a conference by the Director of Agriculture which was attended by representatives from this committee, the Board of Agriculture, Board of Health, Federation of Women's Clubs, the Geological Survey and Sportsmen's League and other organizations, and such a council was considered as a very desirable organization. It is hoped that the organization may be consumated in the near future.

The Naturalists Guide, mentioned in previous reports as in preparation, has recently been issued and no doubt many of our members are already familiar with its contents. It must serve a very useful purpose and additions to the localities listed for Ohio may very properly be presented to this committee or to the Academy through the Ohio Journal of Science.

Reports from different members indicate that there is great need of prompt action to preserve the natural beauty and native condition of some of our state owned tracts. Some places recently made accessible to autoists are reported to be sadly misused and their natural beauty despoiled by the ruthless destruction of shrubs, vines and small trees, which are essential not only to the beauty and scenic attractiveness of the parks, but an essential factor in the preservation of birds and other animals. Definite rules as to use of the park areas and restrictions placed on those who visit them appear to be the only way to prevent such vandalism, but we believe every effort should be made to secure the voluntary compliance with the necessary regulations by the education of the public in the proper use of such state property.

The following recommendations, offered by the Committee on State Parks and Conservation, were unanimously adopted by the Ohio Academy in annual meeting at Columbus, Ohio, April 9, 1926:

1. That we express our appreciation of the progress made in the acquisition of State Forests and Game Refuges and the hope that these may be largely increased in number and extent.
2. That we approve the sanitary regulations for State Parks adopted by the State Department of Health and urge the most cordial and universal support in their enforcement and their extension to other sites.
3. That we heartily approve the organization of an advisory council on State Parks and Conservation, to consist of representatives from the State departments, institutions and societies interested, to consider and advise regarding the best measures for the preservation of the natural features, wild life and the historic and scenic beauties in tracts that are owned or controlled by the State.
4. That we especially urge wherever practicable the setting aside of certain parts of the State Forests and Game Refuges, or other tracts under State control as wild life sanctuaries or preserves, with a view to the permanent preservation of the native associations of plants and animals so that they may serve our own and future generations as examples of the primitive fauna and flora of the State. Where camp sites are allowed these should be restricted to a definite small area and supervised.
5. That we encourage the widest publicity and educational effort to acquaint the public with the need of universal observance of measures to protect from injury or destruction by digging, uprooting, cutting, blazing, mutilation, fire or other means, the wild flowers, shrubs, trees and natural conditions essential to the beauty of the parks and the survival of both plant and animal representatives of our native forms of life.

6. We urge the posting of suitable placards throughout the park areas or reserves to inform all persons as to regulations for the preservation of all wild life.

7. That we urge a wider attention to studies of the native plants and animals on the part of teachers in the public schools and the support of the Audubon societies and the Wild Flower Preservation societies in their laudable efforts to educate the people of the country to a better knowledge of the dangers of extinction for many of our most interesting forms of life.

8. That copies of these recommendations be forwarded by the Secretary to the State departments, institutions and societies known to be interested.

HERBERT OSBORN, *Chairman*,
E. L. FULLMER, E. N. TRANSEAU,
E. LUCY BRAUN, A. R. HARPER,
E. R. HAYHURST, EDMUND SECREST,
C. G. SHATZER, BRUCE FINK.

(The last three—Harper, Secrest and Fink—did not see the above recommendations before they were read and adopted).

Discussion.

Following the reading of the foregoing report, Doctor Transeau, Ohio State University, called attention to the damage being done at Old Man's Cave, by way of emphasizing the importance of the eighth recommendation requiring the Secretary to send copies of the recommendations "to the State departments, institutions and societies known to be interested." Miss E. Lucy Braun, University of Cincinnati, expressed the opinion "that while a letter from the Secretary of the Ohio Academy of Science with these recommendations would be of interest, it would merely be set aside. It should be followed up by the recipient by writing to State officials, who will thus learn that the people of the State know about and are interested in and pushing conservation movements."

Report of the Library Committee.

April 8, 1926.

To the Ohio Academy of Science:

The Library Committee wishes to call the attention of the Academy to the very healthy growth of its exchange list during the past twelve years under the able custodianship of Mr. Reeder, which ended last year, and it desires to convey to Mr. Reeder the thanks of the Academy for his long-continued and unselfish services, and to express its regret at the severance of the relation.

In 1909 Professor Mills, who was then Librarian of the Academy, reported seventeen institutions on the Academy's exchange list. In 1914 the Academy entered into an agreement with the Ohio State University Library concerning the deposit of the library of the Academy with the University Library. Early in 1915 this deposit was made, and the Academy Library and exchanges came under the immediate care of

Mr. Reeder. At the 1920 meeting, Mr. Reeder reported "Sixty-five institutions on the exchange list." In 1921 there were sixty-eight. In 1922 his report read "seventy-one institutions on the exchange list," while at the 1925 meeting he stated "some additions have been made to the list this year."

In nearly every report which Mr. Reeder has made since 1915 he has emphasized the desire of the University Library to serve the Members of the Academy with scientific literature for their research, and its willingness to lend to any member, through his institutional library, any publication needed in research work. He has expressed the hope that more members of the Academy would take advantage of this opportunity so that "more and more the University Library would serve as the center of scholarly research by members of the Academy."

In 1920 he reported loans made by the University Library of only forty-two books to nine Ohio Colleges. It seems to the Committee that a much larger use of the facilities of the University Library should be made by the members of the Academy. Such use of the University Library by members of the Academy is open to them not merely as a courtesy of the University, but as their right under Articles 8 and 9 of the "Agreement Between the Ohio Academy of Science and the State University Library," entered into in 1914.

Since Mr. Reeder's resignation early in 1925 the care of the Academy exchanges has been largely in the hands of Miss McKee, of the University Library Staff, who has been too burdened with other duties to give them adequate attention. Recently, however, Mrs. Ethel M. Miller, librarian of the departments of Botany and Zoology, has been assigned by the University to take charge of the exchanges of both the Academy and the Ohio Journal of Science. She is entering upon her work with enthusiasm and in a very methodical and business-like way. The Academy is to be congratulated upon having its exchanges in such able hands.

The Committee wishes to call the attention of the Academy to several points, where the University Library seems to have failed in its handling of the Academy exchanges.

1. Under Article (5) of the Agreement of 1914, "The University Library agrees to keep a Separate Card Catalogue of the library of the Academy, showing the accession records." While under Article (1) the Academy library is defined as "its collection of books, pamphlets, periodicals and other publications, now constituting its library, together with future additions."

This Separate Card Catalogue does not appear to have been maintained. It seems especially desirable that the Academy should possess such a record of its original library and accessions.

2. In 1917 the Academy voted "that a suitable printed plate, to be paid for by the Academy, be put in the books given to the Ohio State University Library." This plate seems not to have been placed in any of the accessions to the Academy library received by exchange since 1917. The Committee feels that this failure should be rectified.

3. A clear cut separation of accessions to the University Library through purchase, through gift and through exchange of Academy Proceedings and Papers, of the Ohio Journal of Science and of the Ohio Biological Survey publications does not seem to have been maintained. So that in many cases proper credit has not been given for the accessions. For example, certain accessions have been

credited in one place to the Academy and in another place to Purchase. It may be impossible, therefore, to determine at this time, with any degree of accuracy, what accessions have been received through the Academy exchanges. This should be investigated and remedied so far as possible.

The Committee finds that the price list of its Proceedings and Special Papers is practically exhausted. It suggests that the list be brought down to date, that it be published each year with the Annual Report as an advertising page, and that extra copies of the list be issued for the use of the Librarian in answering inquiries. Certain Special Papers are nearing exhaustion. The Committee advises their republication.

The Committee wishes also to submit the accompanying report of Miss McKee, of the University Library Staff, who has had charge during the past year of the sale and distribution of the Academy publications. For purposes of accurate record it is to be noted that the $28.15 referred to by Miss McKee as turned over to the Treasurer of the Academy is made up of two items, viz., $25.53 from the sale of publications during the year, and $2.62, referred to in the last report as outstanding from the sales of 1924, but collected since then.

Respectfully submitted,

FREDERICK O. GROVER, *Chairman.*

Report of Miss McKee for the Ohio State University Library.

To the Ohio Academy of Science:

The University Library received in 1916 a deposit of the Ohio Academy of Science containing a number of exchanges, many of them foreign periodicals. At that time a campaign for additional exchanges was undertaken with the result of about two hundred new titles.

In 1921 letters were again sent out in another attempt for additional exchanges, but results were not so satisfactory. Since that time owing to the rapid increase in the number of students making new demands on the library without a corresponding increase in the Staff, it has been impossible to undertake any systematic effort for new exchanges, although some new ones have been added to the list.

During the past year an attempt has been made to reorganize the records of Academy material in the library and a card record is being established in the Botany and Zoology department library. This record will consist of the titles deposited by the Academy in 1916 with the additional titles added by exchanges established since that time. It will not be a complete record of volumes and numbers to date, as this would duplicate work already being done at the main library, but will give a working list of titles available.

We hope by the next meeting to be able to report to the Academy as to the exact number of volumes and the approximate money value of your exchanges.

An inventory has been taken of the numbers of Special Papers and Proceedings of annual meetings in stock, which is appended. By this it will be seen that numbers 13 and 15 are entirely out of print.

The price list of Special Papers and Proceedings is decidedly out of date and as the supply is low, it might be wise to have a new edition of this list, especially if a campaign for exchanges is to be instituted.

The sale of Special Papers and Proceedings has gone on as usual during the year, amounting to $28.15, which has been turned over to the Treasurer of the Academy.

Proceedings of the 35th annual meeting were received in August and mailed out to the members as soon after that as possible, although we regret that there was some delay in this mailing owing to vacations and illness in the Library Staff.

One of the most valuable tools for the research worker which has issued lately is the "Union List of Serials in the Libraries of the U. S. and Canada." This compilation is the result of co-operation among the libraries of the two countries and is being published by the H. W. Wilson Co., of New York. Each co-operating library receives first a checking list in which it states the periodicals regularly received, and, later a completed list, giving the name of each library receiving a given title regularly. The work has proceeded through the letter R and the completed volumes should be available next year. Already this has proved itself to fill a long felt need.

Work on the filing of cards in the depositary catalog of the Library of Congress is progressing, although it is not yet in shape for use. When this is available the Library will have in this and the Union List two of the most valuable tools possible for inter-library loans of which Academy members may avail themselves.

(Signed) ALICE D. MCKEE,
For Ohio State University Library.

Inventory of Special Papers, Proceedings, Etc., of Ohio Academy of Science, April 1, 1926, in Stock and Deposited with the Ohio State University Library.

CONSTITUTION AND LIST OF MEMBERS.

135 copies.

SPECIAL PAPERS.

1.....188 copies	8..... 90 copies	15..... 0 copies
2.....120 copies	9.....180 copies	16.....186 copies
3.....164 copies	10.....225 copies	17.....288 copies
4.....125 copies	11.....256 copies	18.....198 copies
5..... 69 copies	12.....185 copies	19.....199 copies
6.....125 copies	13..... 0 copies	
7.....242 copies	14.....262 copies	

REPORTS AND PROCEEDINGS.

1..... 89 copies	13.....230 copies	25.....194 copies
2.....134 copies	14.....245 copies	26.....152 copies
3.....176 copies	15.....231 copies	27.....163 copies
4.....212 copies	16.....218 copies	28.....149 copies
5.....182 copies	17.....238 copies	29.....118 copies
6.....189 copies	18.....never published	30.....128 copies
7.....268 copies	19.....560 copies	31..... 50 copies
8.....215 copies	20.....180 copies	32.....352 copies
9.....260 copies	21.....219 copies	33.....294 copies
10.....220 copies	22.....207 copies	34.....303 copies
11.....240 copies	23.....194 copies	35.....282 copies
12.....265 copies	24.....209 copies	

Report of the Committee on Legislation.

April 9, 1926.

To the Ohio Academy of Science:

Your Special Committee on Legislation has been rather inactive during the year just closing, not a single formal meeting of the committee having been held. However, there has been some informal conferences and correspondence among the committee members and the prevailing opinion seemed to be that there was little that could be done at this time. Furthermore, the committee feels that before a renewal of effort before the General Assembly in behalf of any bill is made that the Academy should definitely decide whether or not it really wants to surrender its present informal and independent form for that of a state-supported institution, and if so, then action should be taken to work out a more careful program of the broad services it hopes to render the State before the question of legislation is taken up anew. If anything is to be accomplished in the future along these lines it will be necessary for the Academy first to sell the proposition to itself and then by a united, enthusiastic effort present a proposal of such evident, unquestioned merit that it will sell itself to the General Assembly and the Governor.

Respectfully submitted,

WM. H. ALEXANDER, *Chairman,*
M. M. METCALF, EDW. L. RICE,
PAUL M. REA, L. B. WALTON.

Report of Committee on Election of Fellows.

COLUMBUS, OHIO, April 9, 1926.

To the Ohio Academy of Science:

A meeting of the Committee on the Election of Fellows was held last evening at the office of the Secretary, 16 East Broad Street, Columbus, with a quorum present. Of the candidates considered, five received the necessary favorable votes and were declared elected. The Fellows elected will be personally notified, and the list published in the Proceedings of this meeting.

Respectfully submitted,

WILLIAM H. ALEXANDER,
Secretary, for the Committee.

The following is a list of those elected Fellows:

J. H. GOURLEY, Wooster.
NELLIE F. HENDERSON, Columbus.
ONDESS L. INMAN, Yellow Springs.
HARRY M. JOHNSON, Columbus.
H. C. YOUNG, Wooster.

Report of the Membership Committee.

To the Ohio Academy of Science:

Applications in due form have been received from the following persons and we recommend their election to full membership in the Academy, effective upon the payment of one year's dues, viz.:

Ackerman, Lloyd, Western Reserve University, Cleveland.
Arnold, H. J., Wittenberg College, Springfield.
Baker, (Miss) Margaret, Otterbein College, Cochran Hall, Westerville.
Behre, Charles H., Jr., University of Cincinnati, Cincinnati.
Berry, Fred, State Department of Health, O. S. U., Columbus.
Blocher, John M., 379 Beech Street, Berea.
Bodenberg, Emmett T., Capital University, Columbus.
Boesel, M. W., Botany and Zoology Bldg., O. S. U., Columbus.
Borst, Harold L., Farm Crops Dept., O. S. U., Columbus.
Brown, Helen J., 55 Kelso Road, Columbus.
Cassidy, Harold, 216 S. Maple Street, Akron.
Chappars, M. E., Miami University, Oxford.
Dunford, Ralph E., Dept. of Psychology, O. S. U., Columbus.
Edgerton, Harold A., Dept. of Psychology, O. S. U., Columbus.
Eliot, Theodore Sessinghaus, 2109 Adelbert Road, Cleveland.
Elliott, Rush, Box 421, Athens.
Eye, L. F., Dept. of Health, O. S. U., Columbus.
Fisher, Mildred, 2594 Summit St., Columbus.
Fordyce, George L., 40 Lincoln Ave., Youngstown.
Franks, Roscoe W., 80 W. Eighth Ave., Columbus.
Frayne, J. G., Antioch College, Yellow Springs.
Frey, Carl A., 16 President St., Athens.
Gilmore, R. Clark, Bot. Dept., O. S. U., Columbus.
Hathaway, S. R., 3 Van Vorhes St., Athens.
Hazard, Frank O., Wilmington College, Wilmington.
Hoskins, J. Hobart, Dept. of Botany, University of Cincinnati, Cincinnati.
Hurst, Macleod E., Orton Hall, O. S. U., Columbus.
Hutter, Harry K., 1222 Stewart Ave., Cambridge.
Johnson, Minnie M., 312 W. Ninth Avenue, Columbus.
Johnston, William Drummon, Jr., Dept. of Geology, University of Cincinnati, Cincinnati.
Jones, H. Lee, Antioch College, Yellow Springs.
Kautz, H. W., 4612 Glenshade Ave., Cincinnati.
Keeler, Alma, 377 W. Ninth Ave., Columbus.
Kindel, Dr. D. J., 1442 Neil Ave., Columbus.
Kuechle, Theodore Fred, 1180 Wyandotte Road, Columbus.
Maxfield, Francis N., Dept. of Psychology, O. S. U., Columbus.
Miller, Vernon L., Dept. of Psychology, O. S. U., Columbus.
Miller, Warren C., Bedford High School, Bedford.
Mitchell, Robert H., St. Clairsville.
Moore, Robert A., Hamilton Hall, O. S. U., Columbus.
Petlay, Fred, New Concord.
Pettijohn, Francis J., 136 Woodland Ave., Columbus.
Pfleiderer, E. R., Dept. of Psychology, O. S. U., Columbus.
Phillips, James McIvor, 1952 Iuka Ave., Columbus.
Pratt, Karl C., Dept. of Psychology, O. S. U., Columbus.
Renshaw, Samuel, Dept. of Psychology, O. S. U., Columbus.
Rexroad, Carl N., Dept. of Psychology, O. S. U., Columbus.
Reymert, Martin L., Wittenberg College, Springfield.
Rolland, William A., 2419 Pomeroy St., Columbus.
Roose, Robert L., 16 Lloyd St., Barberton.
Sands, Olive Ruth, 80 Clinton Heights Ave., Columbus.
Seashore, Robert H., Dept. of Psychology, O. S. U., Columbus.
Selbert, (Mrs.) Norma, College of Medicine, O. S. U., Columbus.

Shaw, Margaret F., 312 W. Ninth Ave., Columbus.
Smith, Clayton S., Hamilton Hall, O. S. U., Columbus.
South, Earl B., Dept. of Psychology, O. S. U., Columbus.
Spieker, Edmund M., Orton Hall, O. S. U., Columbus.
Stout, Gilbert Leonidas, Dept. of Botany, Miami University, Oxford. (Home Address) R. No. 5, Lockland, Ohio.
Thut, Hiram F., 1501 Neil Ave., Columbus.
Trautman, Milton B., 618 S. Fifth St., Columbus.
Tryon, Margaret E., Otterbein College, Cochran Hall, Westerville.
Turner, Jean, 80 W. College Ave., Westerville.
Valentine, Willard L., Ohio Wesleyan University, Delaware.
Visscher, J. Paul, Western Reserve University, Cleveland.
Williams, Pearle E., Botany Dept., O. S. U., Columbus.
Wilson, Orville Turner, University of Cincinnati, Cincinnati.
Wilson, William R., Dept. of Psychology, O. S. U., Columbus.
Winnette, Clifford L., 66 East Main St., New Concord.
Wright, Frank J., Granville.

Respectfully submitted,

M. E. Stickney, *Chairman*,
W. M. Barrows,
J. Ernest Carman.

Report unanimously approved.

Report of Nominating Committee.

President—William McPherson, Ohio State University, Columbus.
Vice-Presidents:
Zoology—James A. Nelson, Mt. Vernon.
Botany—N. M. Benedict, University of Cincinnati, Cincinnati.
Geology—Wilbur E. Stout, Ohio State University, Columbus.
Medical Sciences—Emery R. Hayhurst, Ohio State University, Columbus.
Psychology—Garry C. Myers, Cleveland School of Education, Cleveland.
Physical Sciences—Charles H. Skinner, Ohio Wesleyan University, Delaware.
Secretary—William H. Alexander, U. S. Weather Bureau, Columbus.
Treasurer—A. E. Waller, Ohio State University, Columbus.
Elective Members of Executive Committee—C. G. Shatzer, Springfield, and Alpheus W. Smith, Columbus.
Publications Committee—H. C. Sampson, Ohio State University, Columbus.
Trustee Research Fund—Herbert Osborn, Ohio State University, Columbus.
Library Committee—F. O. Grover, Oberlin College, Oberlin.
Committee on State Parks—Bruce Fink, Oxford; E. R. Hayhurst, Columbus; and E. N. Transeau, Columbus.

Respectfully submitted,

Herbert Osborn, *Chairman*, F. C. Waite,
M. E. Stickney, H. E. Burtt,
J. Ernest Carman, F. C. Blake.

The report was unanimously adopted and the above named persons duly elected to the positions indicated. By a previous

action of the Academy, the new President, Dr. Wm. McPherson, and the retiring President, Dr. Paul M. Rea, become the Academy representatives on the Editorial Board of the OHIO JOURNAL OF SCIENCE.

Report of the Committee on Necrology.

COLUMBUS, OHIO, April 10, 1926.

To the Ohio Academy of Science:

The Academy has suffered the loss by death of three of its members during the year just ended, namely, Harry Arthur Gossard, Wooster, Ohio; Henry Curwen Lord, Columbus, Ohio; and Roscoe J. Webb, Garrettsville, Ohio. The following brief notes on the life and work of these esteemed members are presented for your information:

I. HARRY ARTHUR GOSSARD.

Prof. Harry A. Gossard was born on a farm near Ames, Iowa, February 7, 1868, and died at his home in Wooster, Ohio, December 18, 1925. He entered the Iowa State College in 1886 and graduated with honor in 1889. After graduation he was appointed Assistant in Entomology in the Iowa Experiment Station and carried graduate work in the college, receiving his Master's degree in 1892. He served as President of Albion Seminary at Albion, Iowa, 1893 to 1895, and as instructor in natural sciences in the high schools of Rochester, Minn., and Princeton, Ill., from 1895 to 1898, when he was elected Professor of Entomology, Zoology and Geology and Entomologist of the Experiment Station of Florida. He held this position until 1904, when he was selected to fill the position of Entomologist in the Ohio Experiment Station, where he remained until his death.

Prof. Gossard's work was characterized by a very full appreciation of the practical needs of agriculture and horticulture and a very thorough and painstaking method of experiment and investigation. His numerous published papers and the large number of exhaustive studies made by his assistants give abundant evidence of his insight into the basic needs of insect control and the practical applications of scientific results. His worth was recognized in honors from various scientific bodies, one of the most recent being the Presidency of the American Association of Economic Entomologists.

Among his hosts of friends in Ohio and throughout the country he was esteemed as a man of most sterling character, a safe councillor whose judgment always commanded respect and all unite in sincerest sympathy for the bereaved family. In his death the Academy has lost one of its conspicuous contributors to science and the state a conscientious, able administrator in research activity.

II. HENRY CURWEN LORD.

Prof. Henry C. Lord was born at Cincinnati, Ohio, on April 17th, 1866, and died at Columbus, Ohio, September 16, 1925. He studied at Ohio State University during the years 1884 to 1887, and received his Bachelor degree from the University of Wisconsin in 1889. He came to the Ohio State University in 1891, first as assistant in Mathematics and Astronomy, and later, 1894, as Associate Professor of Astronomy, and in 1900 Professor of Astronomy and Director of the Emerson McMillin Observatory, a position he held until his death.

Professor Lord was an intense worker and his talents were recognized not only in his particular field, but among scientific workers in many branches. He was interested especially in astrophysics, but had a wide knowledge in various branches of science and was keenly interested in the educational problems connected with university life. Among his colleagues he was noted and greatly respected for his ability to analyze complex situations and to state his opinions in concise and logical terms.

He took part in a number of Eclipse expeditions and one of his notable achievements was the securing of an exceptionally valuable series of photographs during the eclipse of October, 1900. He was a member of a number of scientific societies,

among them the Royal Astronomical Society and the Astronomical and Astrophysical Society of America, and his published papers appear in a number of scientific journals. He became a member of this Academy in 1915 and was made a Fellow in 1920. He was, no doubt, best known among his colleagues at the University and especially to a favored circle of friends and admirers who will always remember him with affection. We desire to record our sincere sympathy for the bereaved family and relatives in their great loss.

III. Roscoe J. Webb.

Roscoe J. Webb was born at Garrettsville, Ohio, on May 19, 1875. He completed his high school course in his native village in 1894 and entered Hiram College in the fall of the same year, but was compelled by the frailty of his health to give up college work after a few months.

He studied law in his father's office and was admitted to the bar in 1906. Forming a partnership with his father under the firm name of Webb and Webb, he continued the practice of law with conspicuous success and growing reputation until his death on October 3, 1925.

From early youth Mr. Webb was an ardent lover of nature and pursued the study of the *flora* and *fauna* of his region with great industry and success throughout his life. Few men in the northern part of the State had a wider or more accurate knowledge of our native plants. By his many botanical friends he was known as an authority on the botany of his region.

His life was one of unusual service to his community in which he was a most useful and beloved member. He will be greatly missed by a wide circle of friends to whom his character and scientific attainments had greatly endeared him. He became a member of the Ohio Academy of Science in 1898 and though not a frequent attendant upon its meetings nor personally known to many of our members, his services and contributions to science are well known and much appreciated.

Respectfully submitted,

Herbert, Osborn, *Chairman*,
H. C. Beardslee.

Report of the Committee on Resolutions.

Columbus, Ohio, April 10, 1926.

Resolved,

1. That the Ohio Academy of Science expresses its grateful appreciation of the work of the local committee of the Academy, the officers of the Ohio State University, and the Columbus Chamber of Commerce in arranging so satisfactorily for the success of the meeting and for the comfort and pleasure of the members.

2. That the Academy most heartily thank Dr. Douglas Johnson, of Columbia University, for his extraordinarily interesting and instructive lecture on "The Evolution of the Grand Canyon Region."

3. That the Academy recognizes the benefit to be derived from a more intensive study of the responses of insects and other animals to weather factors, such as temperature, humidity, rainfall and light. It recognizes the need for continuous pure science study along these lines, and endorses the proposal for the establishment of an endowed laboratory for the study of the relations of insects and other animals to weather and climate.

4. That the Ohio Academy of Science, in session at the annual meeting, wishes to voice its protest against the granting of long-time rights and privileges in the grazing lands of the National Forests and other Public Domain. The bill recently introduced by Senator Stanfield (S. 2584) or any other such bill, is directly opposed to all principles of conservation; it threatens the integrity of a national organization, and passes control of public lands to private interests. Control of grazing, or other privilege granted in National Forests and Public Domain, must remain in the hands of a centralized body such as the Forest Service, which can administer all interests.

Edward L. Rice, *Chairman*,
F. C. Waite,
E. L. Moseley.

Scientific Sessions.

The following is the complete scientific program of the meeting:

PRESIDENTIAL ADDRESS.

The Social Significance of Science.....Paul M. Rea

PUBLIC LECTURE.

The Evolution of the Grand Canyon Region.....Douglas Johnson

PAPERS.

1. The Franz Theodore Stone Laboratory. (10 min).....R. C. Osburn
2. Science, the Newspaper and the Public. (15 min).....David Dietz
3. The Crested Butte Region of Colorado. (20 min.) (lantern), Clarence H. Kennedy
4. Effects of Ultra-violet Radiation on Inorganic Compounds, Enzymes, and Living Organisms. (20 min.) (lantern).....Robert C. Gowdy
5. Some Recent Experiments Bearing on the Problems of Sleep. (15 min.) H. M. Johnson and Geo. E. Weigand
6. A Quantitative Life History of Sweet Clover Stand. (15 min.) (lantern), O. J. Willard
7. A Waterspout on Lake Erie. (10 min.) (lantern).....Frederick H. Krecker
8. Some Notes on Genetics. (10 min.).....L. B. Walton
9. The Cost of Quick Shift of Learning Habits. (10 min.) (lantern), Garry C. Myers
10. The Corn Borer Invasion of Ohio. (20 min.).....Herbert Osborn
11. Symposium: Animal Parasitism.
    (1) The Past and Future of Medical Parasitology. (15 min.), Frederick H. Krecker
    (2) Parasites as Natural Enemies of Insects and the Relatively High Cost of Artificial Controls. (10 min.).....Dwight M. DeLong
    (3) Parasites of Economic Importance in Fish of Ohio. (10 min.), Ralph V. Bangham
    (4) Notes on the Mallophaga of Ohio Birds. (10 min.)...Harold S. Peters
    (5) Some Interesting Tachinid Parasites of the Gipsy Moth. (10 min.), H. W. Allen
12. Symposium: Biological Training for Medicine and Dentistry.
    (1) Papers by—
        Dr. F. L. Landacre. (20 min.).
        Dr. Frederick C. White. (20 min.).
    (2) Discussion by—
        Dr. Raymond C. Osburn. (5 min.).
        Dr. Edgar N. Transeau. (5 min.).
        Dr. Edward L. Rice. (5 min.).
        Dr. L. B. Walton. (5 min.).
13. Notes on Computing Mean Temperatures for Biological Purposes. (10 min.) (lantern).....C. R. Cutright
14. Some Physiological Studies with Hessian Fly. (10 min.).....T. H. Parks
15. Eugenic Data from Families of College Freshmen. (10 min.) (Wall charts).....Robert A. Hefner
16. The Mouthparts and Gonopads of Polyzonium Rosalbum, a Suctorial Millepede. (10 min.) (diagrams).....Stephen R. Williams
17. Value of Scientific Work in the Ohio Division of Fish and Game. (10 min.), E. L. Wickliff
18. Measuring Locomotion and its Variable Components in the Manure Worm. (*a. foetida*). (10 min.).....Wm. M. Barrows

19. Notes on the Ecology of Goniobasis livescens. (10 min.) (wall charts; mounted shells).....ROBERT A. HEFNER
20. Unusual Ohio Faunistic Records Based on Specimens in the State Museum. (10 min.).....JAMES S. HINE
21. Some Variations in Drosophila hydei and Drosophila funebris. (10 min.), WARREN P. SPENCER
22. The Range of Tolerance of Three Species of Euglena for Hydrogen Ions. (10 min.).....W. J. KOSTIR
23. The Origin of the Pleurites in the Insects. (10 min.).....L. B. WALTON
24. Plant Successions in Portage County, Ohio. (20 min.) (lantern), H. C. SAMPSON
25. Further Notes on the Vegetation of Ohio. (20 min.) (lantern), E. N. TRANSEAU
26. The Plant Communities of Adams County, Ohio, and Their Relation to the Geological Formation. (15 min.).....E. LUCY BRAUN
27. Non-dependence of Sexual States on Allosomes in Japanese Hop. (10 min.), J. H. SCHAFFNER
28. Inoculation Experiments with Tomato Streak. (15 min.).....W. G. STOVER
29. Opening of Stomata in Different Wave-lengths of Light. (15 min.), J. D. SAYRE
30. Ohio Mosses. (5 min.).....NELLIE F. HENDERSON
31. New and Interesting Fungi for Ohio. (20 min.) (lantern)...H. C. BEARDSLEE
32. The Ohio Puffballs. (10 min.).....MINNIE M. JOHNSON
33. Some Interesting Fungi Recently Found in Ohio. (5 min.)...W. G. STOVER
34. Siamese Twins of Arisaema Triphyllum of Opposite Sex Experimentally Induced. (5 min.).....J. H. SCHAFFNER
35. Range of H-ion Concentration in Leaves and Stems of Plants. (10 min.), J. D. SAYRE
36. Fossil Plants from American Coal Balls. (15 min.) (lantern), J. HOBART HOSKINS
37. On the Great Number of Seeds Produced by a Single Plant. (5 min.), EDO CLAASSEN
38. Observations on a Species of Euglena Frequently Found Growing on a Clay Surface. (10 min.).....E. L. FULMER
39. Seasonal Variation in the Physical Properties of Evergreen Leaves. (15 min.) (lantern).....B. S. MEYER
40. Drainage Changes in Northeastern Washington. (20 min.)..CARL VER STEEG
41. Saw-Teeth Forms in Virginia. (10 min.).....GEO. D. HUBBARD
42. Reaction Profiles of Surficial Materials. (10 min.).....G. W. CONREY
43. Some Shore Line Pot Holes at Half Moon Bay, California. (10 min.) (lantern).....A. C. SWINNERTON
44. A Hamilton Fauna from Northwestern Ohio. (10 min.)...GRACE A. STEWART
45. The Cynthiana Formation of Kentucky. (10 min.) (lantern)..PAUL H. DUNN
46. The Structure of the Siphuncle in Fossil Cephalopods. (20 min.), AUG. F. FOERSTE
47. Monongahela Formation in Eastern Ohio. (5 min.).....WILBER STOUT
48. Deep Wells of Southern Ohio. (5 min.).....MILDRED FISHER
49. Origin of the Natural Brines of Eastern Ohio. (15 min.).....R. C. LORD
50. Methods of Studying and Correlating Erosion Cycles. (10 min.), GEO. D. HUBBARD
51. Some Observations on the Validity of the Erosion Levels in Eastern Ohio. (20 min.).....C. F. MOSES
52. Molding Sands Investigated by the Commercial Club of Cincinnati Resource Survey. (10 min.) (lantern).....P. WILLARD CRANE
53. Notes on Heredity in Man. (5 min.).....L. B. WALTON
54. Occupational Diseases Reported to the Ohio State Department of Health for the Five-Year Period Ending June 30, 1925. (15 min.), E. R. HAYHURST AND D. J. KINDEL
55. Transposition of Vessels of the Heart. (12 min.).....R. A. MOORE
56. Paradoxical Coronary Embolism. (12 min.) (lantern).....ERNEST SCOTT

57. Complete Dissecting Aneurysm of the Aorta. (12 min. (lantern), J. E. Hoberg
58. A Hitherto Unrecognized Body Function and the System which Operates It. (12 min.).....S. G. Zinke
59. The Origin and Duration of the Enamel Cuticle (Nasmyth's membrane). (12 min.) (lantern).....S. W. Chase
60. The Relation of Hysterectomy to the Oestral Cycle. (10 min.), E. P. Durrant
61. Factors Influencing the Oestrous Cycle of the Rat. (10 min.)...M. O. Lee
62. Fatigability of Castrated Rats. (10 min.).....M. Gans
63. The Differentiation of the Primitive Ectodermal Lines of Amblystoma. (10 min.).....F. L. Landacre
64. The Interpretation of Recent Studies of the Effects of Insomnia. (15 min.), H. M. Johnson
65. The Beginnings, or Foundation, of Disease, and Their Cause. (5 min.), S. G. Zinke
66. Effect of Subcutaneous Injection of Luteal Extract on Cyclic Activity of Female White Rats. (5 min.).....E. P. Durrant
67. Celloidin injections for the Demonstration of Vascular Pathology, Ernest Scott and R. A. Moore
68. Peculiar Perforation of the Intestine.....Ernest Scott
69. The Thyroid Influence on the Behavior of the White Rat. (10 min.), Edna Rickey Lotz
70. Some First Indications of Value of Tests for Learning Nonsense Syllables in School Survey. (15 min.).....Florence Mateer
71. Experimental Studies of Certain College Problems. (10 min.), Luella C. Pressey
72. A Philosophical Foundation of Psychology from the Point of View of Phenomenology. (15 min.).....Paul B. Means
73. The Price of Speed Pressure to the Learner. (15 min.) (lantern), Garry C. Myers
74. Fundamental Drives and the Doctrine of Sublimation. (15 min.), H. Austin Aikins
75. The Nature of Quality. (10 min.).....R. D. Williams
76. Mechanism in Psychology. (10 min.).....A. P. Weiss
77. *How the Spectroscope Reveals the Structure of Atoms. Prof. Henry G. Gale, University of Chicago.
78. *The Size and Shape of Molecules. Prof. Edward Mack, Ohio State University, Columbus.
79. *Crystals and Their Structure. Prof. W. J. McCaughey, Ohio State University, Columbus.
80. †Ultra-violet Filters. (10 min.) (lantern). Robert C. Gowdy, University of Cincinnati.
81. †Some Models of Electronic Phenomena. Alpheus W. Smith, Ohio State University.
82. †Measurements of Sound Intensity by Means of a Rayleigh Disk. C. H. Skinner, Ohio Wesleyan University.
83. †Line Absorption Spectra and Their Relation to Energy Levels. John G. Frayne, Antioch College.
84. †Planetary Nebulae and Stellar Evolution. Donald H. Menzel.

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* These papers were read before a meeting of the Non-Biological Section of the Ohio Educational Conference, to which the members of the Physical Sciences Section of the Ohio Academy of Science were invited.

† These papers were read at a joint session of the Physical Sciences Section of the Ohio Academy of Science and the newly-organized Central Ohio Physics Club.

DEMONSTRATIONS.

1. Transposition of Vessels of the Heart.....R. A. Moore
2. Celloidin Injections for the Demonstration of Vascular Pathology, Ernest Scott and R. A. Moore
3. Photomicrographs Used in Teaching Dental Histology.....S. W. Chase
4. Figures Illustrating the Development of the Face, Jaws, and Teeth in the Pig.....B. M. Patten
5. Skins of "Hen-feathered" bantams, Showing Effect of the Gonad Feather Form and Color.....T. S. Eliot (Introduced by Dr. F. C. Waite)
6. Activity Cage Used in Physiological Laboratory at Ohio State University, E. P. Durrant
7. Charts in Genetics.....L. B. Walton
8. Drawings Illustrating Origin of Pleurites in Insects.....L. B. Walton
9. Specimens of Belgian, English and American Coal Balls...J. Hobart Hoskins
10. A Hamilton Fauna from Northwestern Ohio.....Grace A. Stewart
11. Siamese Twins of Arisaema of Opposite Sex.....John H. Schaffner
12. Sex-reversal in Japanese Hop.....John H. Schaffner
13. Chimera-like Sex-expression in the Cat-tail.....John H. Schaffner
14. Leaf Series in the Rejuvenation Zone in Hemp.....John H. Schaffner
15. Map Showing the Hydrogen-ion Concentration of Lakes and Streams of Ohio.....E. L. Wickliff
16. Graphs or Seiches and Tides on Lake Erie.....Frederick H. Krecker
17. Goniobasis Livescens from Varied Habitats.....R. A. Hefner
18. Photographs Showing the Retention of Snow upon a Wind-swept Area by a Heavy Rate of Seeding Wheat.....Clyde E. Dike
19. Variations in a Species of Polyporus.....F. O. Grover
20. Tomato Streak, Artificial Inoculations.....W. G. Stover
21. Two Fungi Parasitic on Other Fungous Species.....W. G. Stover
22. Photo-micrographs and Line Drawings of North American Species of Deltocephalus Species.....D. M. DeLong
23. Illustrations of Foerster's Types of Odonata.....Clarence H. Kennedy
24. (Room 52, B. & Z. Bldg.). Apparatus for Measuring Locomotion of Earth Worms Under Controlled Conditions, Wm. M. Barrows and K. C. Pratt
25. A Culture of Englena on Clay.....E. L. Fulmer

THE LATERALIS GROUP OF THE BOMBYLID GENUS VILLA.

REGINALD H. PAINTER,
Department of Zoology and Entomology.

The following notes are given in an attempt to make available a key and descriptions to a part of the "clear winged" species of the genus *Villa*. Together with the *Alternata group* and perhaps a few others, these species may be considered to constitute the entire genus as defined by Bezzi and the remaining American species of the old genus *Anthrax* would be distributed among several other genera. If his lead in this matter is followed at least two new genera will have to be made to receive some of these species, but the whole matter should receive attention only when the greater majority of the species of the old genus *Anthrax* and a considerable number of new specimens are available for study. The clear-winged species were named the subgenus *Hyalanthrax* by Osten Sacken (7), and may be distinguished as having:

1. Front tibia with or without spines.
2. Face very little projecting, convex.
3. Third antennal joint short-conical, merging gradually into the style.
4. Wings hyaline or with only C, Sc, 1st M, and R and the veins inclosing them darker.

Most of the species may be divided as follows:

1. Front tibia without spines, or if minute bristles are present, the abdomen is two or more times as long as wide (slender).....*lateralis sub-group*
2. Front tibia with spines or if these are lacking the abdomen is less than two times as long as wide (robust).....*alternata sub-group*

In *V. lateralis* var. *nigra* Cress, there are a few minute bristles on the front tibia and in *V. molitor* Lw. the number of spines present is variable; possibly they may be absent in a few specimens. Outside of these two cases and one mentioned by Cresson (5, p. 444) the presence or absence of these spines appears to be a usable character and the only structural one in the group.

All types unless otherwise stated are in my own collection.

Lateralis Sub-group.

In addition to the ones given in the key the following probably also belong here: *gemella* Coq., *hircina* Coq., *nebulo* Coq., *squamigera* Coq., and *telluris* Coq. *Turbata* Coq. and several of Cole's species are quite similar to this group of species, but are distinguished by having the mesonotum yellowish tomentose. No attempt has been made for an exhaustive study, but the material which was available has been described.

Key to the Species.

1. Cell R and the base of R1 brownish.....2
   Wings hyaline except sometimes costa and subcosta.....4
2. Tomentum of face blackish or brown.....*shawii* (Johns.)
   Tomentum of face light yellow or white.....3
3. Dorsum of abdomen without black tomentum.....compressus n. sp.
   Dorsum of abdomen with black tomentum.....*faunus* (Fab.)
4. A median longitudinal stripe of yellow tomentum on mesonotum *muscaria* (Coq.)
   This stripe not present.....5
5. A tuft of black scales on the sides of segment three.....6
   Black scales on the sides of segment three and four generally absent or reduced to a few scattered ones.....salebrosus n. sp.
6. Scales on sides of segment three brown to white; many brown scales intermixed with the usual black tomentum of abdomen and thorax; venter nearly all pale tomentose.....*mucorea* (Loew)
   Scales on sides of segment three black; tomentum not mixed; venter with bands of dark tomentum.....7
7. Deep, reddish-brown tomentose bands on segments 5 and 6...*concessor* (Coq.)
   Tomentose bands on 5 and 6 the same color as the light colored tomentum on the remainder of abdomen or black.....8
8. Scales on widened base of costa mostly yellow.....*flavocostalis* n. sp.
   Scales on widened base of costa all or mostly black.....*lateralis* (Say)

Villa lateralis (Say).

The 177 specimens of this species and its varieties that I have examined come mainly from Texas and New Jersey, but also there are specimens from Ohio, Tennessee, California, Georgia, Ontario, Arizona, Kansas, Massachusetts, Colorado, and Iowa, Guatemala, British Columbia, Washington, and New York. For the typical specimens I have accepted Cresson's diagnosis of this species and followed his description (5; p. 440).

In addition to the genitalia the sexes may be distinguished as follows: (1) In the female a patch of long curly white or yellowish scales is present on the sternopleuræ and overlaid by long thin hairs. In the male these latter are present but the scales are lacking. (2) The width of the front in the female is nearly twice that of the male. (3) In the female on either side of segment 7 of the abdomen there are small patches of silvery scales (in one or two very dark yellow or orange colored specimens these are yellowish). In the center the scales are black, often with some yellow scales at the base. In the male the number of silvery

scales varies from a condition in all respects like the female (*sabina* O. S.?) to one in which all the scales on segment 7 are silvery. This character does not seem to be linked with the geographic distribution, for I have extremes of the series from both N. J. and Texas.

The ground color is generally black; often with the outer sides of segments 2 and 3 of the abdomen reddish. A specimen from Tennessee has most of the abdomen dark brown; otherwise it is a typical *lateralis*. The color of the lighter pile and tomentum varies from almost an orange to nearly white. There is considerable variation in the color of the scales on the venter of the abdomen and also in the amount of yellow scales on segments 3, 5, and 6; but these variations cannot be well enough characterized to give them a varietal name. The color of the knob of the halteres varies from white to dark brown without correlation with other characters. The costal and sub-costal cells vary from hyaline to dark brown. The scales on the mesonotum are brassy sometimes.

In view of the observations given above, *sabina* O. S. may be distinguished from *lateralis* only in having segment 7 with "a tuft of snow white hair on each side" (if it is hair). Osten Sacken had only a single specimen of *lateralis* from Eastern U. S. for comparison when he drew up the description of *sabina*. It seems that they are synonyms.

The Texas specimens were taken on *Tetraneuris linerais*, *Dicrophyllum marginatum* and *sumac* principally, and I have them from central and southern parts of the state. Possibly it is the commonest Bombyliid there and is found from March until November.

Varieties of V. lateralis (Say).

Coquillet, Johnson and Cresson from time to time have distinguished several varieties of this species and given them names. As indicated below some of these intergrade into the typical species, while others, according to our present collections, do not. Although it is often possible to distinguish only the more extremes of these intergrading forms, yet the naming of the varieties simplifies the placing of specimens in this variable species. I have not seen the variety called *gracilis* by Johnson (Canad. Ent., 15, p. 14), but the form is not the same as the one so-called by Coquillett, whose determination I have followed. I would therefore give this variety the new name *johnsoni*, retaining *gracilis* for the species described by Coquillett, which species belongs in the *alternata* group. Some varieties occur throughout the range of the species; others are more local, according to my material.

KEY TO *Lateralis* AND VARIETIES.

1. Bands of light colored tomentum on abdomen wide; a yellow tomentose triangle in front of scutellum.....4
   Bands of light colored tomentum on abdomen narrow or lacking; dorsum of thorax black tomentose.....2
2. Pile of pleura black.....*nigra* Cress.
   Pile of pleuræ white or yellow.....3
3. Tomentum of face yellow.....*ater* n. var.
   Tomentum of face black and shining.....*johnsoni* n. nom.
4. All legs or at least femora reddish yellow in ground color.....*fulvipes* Coq.
   Legs black.....5
5. Light colored tomentum of dorsum all of about the same shade, whitish yellow to golden; legs black.....*lateralis* Say
   Light colored tomentum not all of about the same shade.....6
6. Light colored tomentum white except on abdominal segment 7 and on prescutellar triangle.....*arenicola* John.
   Light colored tomentum white, or lighter only on 2nd segment of abdomen; a very broad band of silvery scales in the male on abdominal segment 7.....
   faustina O. S.

Var. *faustina* (O. S.).

This variety was named as a distinct species by Osten Sacken, who, however had, at that time, only a single typical specimen of *lateralis* for comparison.

The males may be distinguished by the very broad band of silvery scales on segment 7, which point inwardly from each lateral border and meet in an indistinct line down the center of the segment; second segment with a crossband of white scales thus lighter in color than the bands on the other segments. The border of golden tomentum on the posterior margin of the scutellum is replaced by black scales entirely in most specimens or reduced in others; color of entire lighter body pile and tomentum whitish yellow. The females are practically indistinguishable from the typical *lateralis*. The femora in both sexes are sometimes lighter in color, in this respect resembling var. *fulvipes*, and from which they probably cannot be separated. Originally described from Mexico. There are 8 males from San Gabriel Mts., Cal., June and July; 2 males from Clear Creek and Chimney Gulch, Col., in the Ohio State University collection. Two females taken with the California males are probably the other sex of this form; they differ from *lateralis* only in having the crossband on 2nd segment slightly lighter. All specimens in the Ohio State University collection. I have also seen a female in the collection of R. C. Shannon from Ritzville, Wyoming, taken in August.

Var. *fulvipes* (Coq.)

Differs from the typical *lateralis* only in having the femora and often all the legs wholly reddish yellow in ground color instead of black. The lighter colored pile tends to be rather whitish. One male and one female, San Angelo, Texas, Sept.; 1 female, Brownwood, Tex., Sept., and in collection of R. C. Shannon, 1 female, Coules City, Wyo. In the O. S. U. collection 1 female, Ira, Ohio, 1 female, Gualan, Guatemala, and 1 female, Clementon, N. J.

Another female, Austin, (April), in my collection, has all yellow legs but is suggestive of *faustina* on account of the white tomentum on segments 2 and 4.

I have a male and 2 females from Austin (April) and Brownwood (June) in which only the bases of the femora are lighter in color. These must be considered to be intermediate between this variety and the typical *lateralis*.

Var. *nigra* Cresson.

"Tomentum of abdominal dorsum, venter and patch on pleura entirely black or with narrow basal band on segment 4. Lateral scales of segments 3–6 entirely black or a few white on 4. The usual silvery scales on 7 present." (Cresson, Ent. News, 27, p. 442.)

The tomentum of the face is grayish to shining. The variety may be distinguished from Var. *johnsoni* [n. nom for *gracilis* Johns. (nec Macq.) (6).] by the color of the hair on the pleura. Six specimens, Ontario, Onaga, Kan., Framingham, Mass., Cincinnati, O., all males and all except the Framingham specimens in the O. S. U. collection; also 2 males in R. C. Shannon collection from Ann Arbor, Mich., and Tarrytown, N. Y. The specimens may be arranged in a series with regard to the amount of light colored pile on the venter; ranging from only a few white scales on the first two segments to one with a good many on each. The specimen from the last named locality, which has the most light colored tomentum on the venter also has a few whitish scales on the dorsum of segments 2, 3, and the sides of 4; the rest of the dorsum with black scales, thus showing a tendency toward the typical form.

In my collection there are four males from Riverton, N. J., and there is a male from Ames, Iowa, in the collection of Mr. Hull which have the tomentum of the face black with a grayish reflection in some lights. The hair is black on the pleura. These might be considered a separate variety but I doubt the necessity of separating them from *nigra*. All the specimens of *nigra* which I have seen have 3 or 4 very minute bristles on the front tibia, which are about half the size of those generally found on the *alternata* group.

Var. *ater* n. var.

All tomentum of the dorsum of the thorax metallic, black and shining; edge of the scutellum with a few yellow scales; tomentum of face yellowish; pleuræ yellow haired, whitish in the female. Otherwise as in *lateralis*. Length 10 mm.

Type: Male, Riverton, N. J., July 28, 1920.

Allotype female, Austin, Texas, Sept. 11, 1922.

Paratypes: 1 male, Riverton, N. J., in my collection and 2 males, Akron, and Ira, Ohio, in the O. S. U. collection.

This variety has the yellow tomentose triangle of the front of the scutellum of the typical *lateralis* replaced by black scales. It is closely related to *nigra* and *johnsoni* and has the tomentose bands on the abdomen rather narrow. The venter has most of the segments with white scales.

Var. *arenicola* Johnson.

I have seen 15 specimens of both sexes form Coules City and Stratford, Wyom., in the collection of R. C. Shannon. The variety is well described by Johnson thus: "6 to 7 mm. in length, with white tomentum and pile. The only yellow tomentum is a small triangular patch in front of the scutellum and sometimes scattered scales on the terminal segment of the abdomen. The second, third and fourth segments have prominent basal bands of white tomentum. This form seems to be more numerous in the spring."(6).

Villa flavocostalis n. sp.

Tomentum of the widened base of the costa orange yellow; black scales along the anterior margin of the costa. All light colored tomentose bands of the abdomen very wide; 4, 5, and 6 with only a few rows of black scales, 2 and 3 with more black scales. Remainder of the structure and distribution of the pile and tomentum as in *lateralis*. Length 13 mm.

Type: female San Angelo, Texas, Sept. 13, 1921.

Paratypes: 2 females, Brownwood, Texas, June 17, 1921, and Sept. 22, 1925.

This may be only another variety of *lateralis* but it will require more specimens, especially males, to tell for certain. The appearance is quite distinctive.

Villa concessor (Coq.).

A female from Miner's Peak, Utah, in D. G. Hall's collection and a male in my own collection from Brownwood, Texas, Sept. 22, 1925, and a male in the Ohio Collection from Los Angeles Co., Cal. Cresson considered this a variety of *lateralis* but the deep reddish brown tomentose bands on the 5th and 6th segments are quite striking. I have never seen this condition approached among the typical *lateralis* specimens which never get darker than a golden yellow and this equally on all segments. The sparse pile on the thoracic dorsum is twice as long as it is in *lateralis* in relation to the size of the specimens, and the appressed blackish tomentum of the thorax has a much more metallic luster.

Villa mucorea Loew.

In general appearance much like *lateralis* but somewhat stouter. The chief differences are: Black tomentum much interspersed with brown, seeming to alternate in indefinite longitudinal stripes on the mesonotum. The usual yellowish tomentose triangle in front of the scutellum mixed black and brown tomentose with whitish tomentum on all margins of the scutellum. All pile white, short and erect on dorsum of thorax. Brown to white scales on the sides of segment 3 (where they are black in *lateralis*). Abdominal pattern much like *lateralis* but the tomentum is brown in *mucorea* where it is black in the former.

Loew had a single female from Nebraska, and I have seen in R. C. Shannon's collection 2 males from Stratford, Wyom., Sept. 4th, and Ritzville, Wyom., Sept. 9th. Taking into consideration the difference in sex they agree very well with Loew's description.

Villa salebrosus n. sp.

Female: Ground color black; pile and tomentum of face, and tomentum of front silvery; pile of front black; pile and tomentum of first joint of antennae silvery below, black above. Thorax marked as in typical *lateralis*. Sides of the abdomen at the base with a long yellow bushy pile which emerges into long scales on the sides of the 3d segment. The scales are black on the sides of segments 5 and 6 and yellow on 7. There are two or three black scales on the sides of segment 3. The black tomentose crossbands on the dorsum of segments 1 to 4 do not reach the sides but are half lens shaped. A fringe of black scales on the apex of segments 5, 6 and 7. Venter white tomentose, a narrow band of black tomentum on the bases of segments 3, 5, 6, and 7, and a spot in the center of the base of segment 4. Legs black, black tomentose. Femora with white tomentum at the base. Length 12 mm.

Type: Female San Angelo, Texas, Sept. 13, 1921.

Paratypes: Two females, Brownwood, Texas, Sept. 16, 1920.

The erect yellow pile on the sides of the abdomen gives this species an appearance different from typical *lateralis* or *flavocostalis*.

Villa muscaria Coq.

There are 2 females and 1 male specimens in the collection of O. S. U. from Montclair and Berkeley, Col., in August and September. The principal characters of the species are: the median longitudinal yellow tomentose stripe across the center of the thorax, the black tomentum at the apex of segments 5 and 6, and the legs chiefly yellow. This species and species *salebrosus* differ from the others in having the black scales of abdominal segment 3 largely replaced by yellow ones; the thoracic stripe is not prominent in the male.

Villa faunus Fab.

There are three specimens from Onaga, Kan., and one from Spring Creek, Ga., which are thus labeled in the O. S. U. collection and evidently are similar to the specimens which Coquillett had. There is a female of this species in the collection of H. J. Reinhard, taken at Moore, Tex., June 7. So far as I can tell they differ from *lateralis* only in having expanded costa with a patch of yellow scales among the black; and in having cells C, Sc, 1st M, R, and the base of R5 and R1 quite brownish.

Villa compressus n. sp.

Male: Ground color, dull black. Genitalia and 1st joint of antennæ yellowish red. Face and front yellowish tomentose and black pilose, a patch of large white scales between the antennæ and on the lower part of the front. First two joints of the antennæ black haired. Occiput white tomentose and yellowish pilose. Thorax yellow pilose, on sides and in front short black, scattered pilose on dorsum. A patch of white pile below the root of the wing and extending to the front of the thorax. The tomentum of the mesonotum consists of narrow yellow scales with a V-shaped stripe of white ones about one-quarter of the way from the

front of the thorax. Longer white tomentum above the roots of the wings and at the base of the scutellum form with this stripe an irregular circle on the dorsum of the thorax. Remainder of the scutellum yellow tomentose. Spines of scutellum and thorax yellow. Abdominal tomentum of narrow scales mostly yellow; wide white stripes of tomentum on the bases of segments 3, 5, 6 and 7. Pile white on the sides as far down as the middle of the 3d segment, beyond that they merge into long narrow yellow scales intermixed with stiff black hairs. Similar hairs on the apex of each segment and on the coxæ. A tuft of white pile behind the wings and halteres. Length 7 mm. Wings hyaline except cells C, Sc, R, and a trace of a cloud on the bases of Cu 1 and R 5.

Type: Male, Brownwood, Texas, Sept. 16, 1920, in my own collection.

This specimen runs to *inculta* in Coquillett's key (Trans. Am. Ent. Soc. XIX, July, 1892), but differs in the coloration of the antennæ and vesture of the face and abdomen.

This species differs from the remaining species dealt with in this paper in a way which is difficult to characterize. The smaller size, shorter but broader abdomen and the tomentum which consists of very narrow scales, seem to be the more important differences. The following species, which I have seen in the National Museum, and perhaps some others are quite similar; *inculta*, Coq.; *crocina*, Coq.; *tantilla*, Coq.; *variata*, Coq.; *cinefacta*, Coq.; *terrena*, Coq.; *gemella*, Coq.; *hiercina*, Coq.; *torbata*, Coq.; *anna*, Coq.; *comparata*, Tucker; and *alta*, Tucker. Possibly they constitute at least a separate group but lack of material has prevented my further study of them.

Villa shawii Johnson.

There are 3 females and 1 male from Clementon and Iona, N. J., in the O. S. U. collection. This species is easily distinguished by the dark orange pile, dark tomentum of the face, and the brown anterior border of the wing. Cell R and R1 are also dusky in these specimens.

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THE NATURAL VEGETATION OF OHIO.
III. PLANT SUCCESSION.

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PRELIMINARY STATEMENT.

In the preceding papers of this series (1) it has been shown that within the glaciated area the physiographic results of glaciation offer the best general key to the pattern of natural vegetation. The results of glaciation, in turn, have been largely influenced by preglacial conditions.

In analyzing the composition of the natural vegetation of Ohio certain groups of associations were distinguished, to wit, Prairie, Ash, Oak, and Beech. Each group includes several related classical associations as described by Cowles (2) and others.

Geographical influence is very marked in the detailed composition of these association groups. Plants whose centers of distribution—in the sense that Waller has employed the term (3)—lie outside of Ohio, occur under proper ecological conditions in those parts of the state most accessible to them. The southeasterly (xerophytic), southern and southwestern (generally mesophytic) elements in these admixtures are most widespread and the boreal least so. Northeastern and western elements are of intermediate importance.

The task of the present, concluding, paper of the series is to develop salient facts with regard to the natural plant succession, particularly in the glaciated Erie Basin. Since the aim is essentially historical, no space will be given to discussion of the excellent detailed modern work of Jennings, Dachnowski, Schaffner, and others, further than to state that their results seem to be entirely consistent with those obtained from a study of early sources.

It will be recalled (1) that Riddell's Western Flora contains considerable habitat data, especially with reference to prairie and related associations. Fig. 1 represents a tabulation of all species listed by him according to habitat. Apart from the very large group which must be classed as miscellaneous in

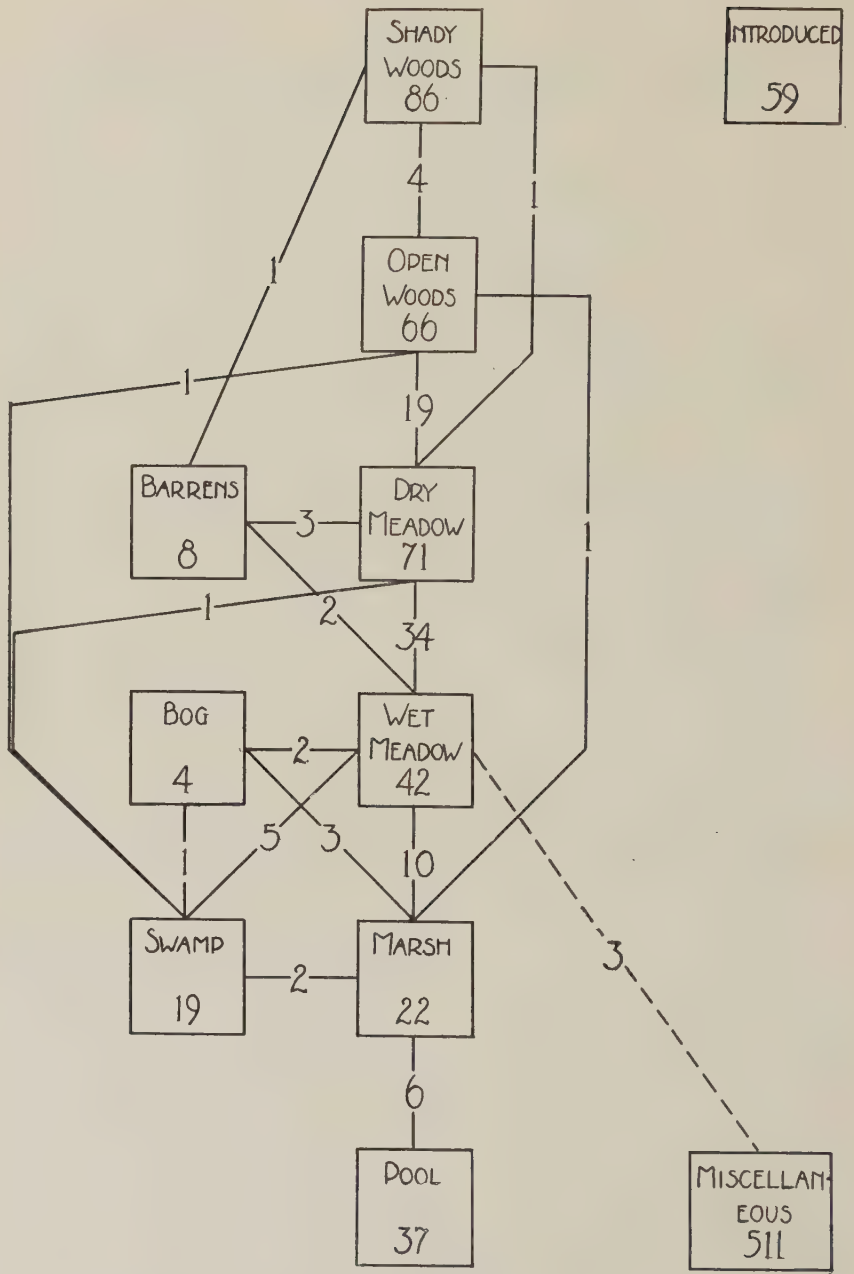

Figure 1.

Succession diagram obtained by statistical analysis of habitat notes in Riddell's Western Flora, 1835. The number of species peculiar to each distinctive habitat was obtained, also the number of species occurring in more than one habitat. The resulting sequence is perfectly definite.

habitat, it will be seen that certain very distinct habitat groups appear. Moreover, if these groups be arranged so that those having large numbers of species in common are in juxtaposition, a very definite sequence develops for the whole series. This sequence, beginning with open water (Pool), runs into Marsh, Wet Meadow, Dry Meadow, Open Woods, and culminates with Shady Woods. Swamp, Bog, and Barren form offshoots of the main series. It is a curious fact that only the hydrarch succession can be developed from these habitat notes, data on the "miscellaneous" species being so vague ecologically that it cannot be analyzed. However, we know that Riddell's peculiar interest lay in the prairie, nor did he seemingly appreciate the problems suggested by great areas of swamp forest ("Ash") in northwestern Ohio, although he visited this district in 1836 (4). Neither is it surprising that, living as he did in southwestern glaciated Ohio, the xerarch series of the unglaciated region failed to resolve themselves clearly in his mind. Botanists more recent than Riddell have had their troubles with these series.

Something of the inherent difficulty of analyzing the xerarch series becomes evident by inspection of our next line of historical evidence, to wit, a tabulation of notes made by the first geologists, (5).

These notes have been arranged below in order of the age of the rock strata examined as nearly as the same can be identified. Only the unglaciated region is here considered.

2nd Report: "Blue Limestone" (Ordovician).

p. 207. Trees even on wet upland flats, which, however, dry early.
p. 216. Wet bottoms, drying early, very fertile—gigantic sugar maple, oak, black walnut, elm, sycamore, hickory, honey-locust, ash, etc.

"Great Marl Stratum" (Upper Silurian).

p. 243. Mound-like outliers, "bald hills,"—coarse prairie herbs. Levels—white oak flats.
Talus slopes, sugar-maple. p. 250, "coves" of talus, id.

"Cliff Limestone" (Upper Silurian).

p. 212. Cliffs, etc., topped by cedars. p. 252, p. 256. id.
p. 253. Thin soil, nearly level—white oaks. p. 254, terrace—common oak. p. 266, oak forest.
p. 252. Hillside showing huckleberry and chestnut which are scarce on limestone—(but this hill was capped with sandstone).
p. 269. Slope—fine oak forest with service tree and shrubby Hypericum.
p. 242. Level, loam-covered, fertile—hickory, oak, black walnut, sugar-maple, dogwood, sassafras, and gigantic poplar—the characteristic tree.

"Slate" (Upper Devonian).

p. 270. Disintegrating slate—almost barren, a few pines.
p. 251. Residual soil—cedar, pine, chestnut, oak.
p. 262. Hillside, abundant sweet gum; slopes, sugar maple, etc.
p. 254. Hillside showing huckleberry and chestnut "the signs of slate" (this hill was capped with loose sandstone, rolling down).
p. 260. Broad slate bottoms—heavy growth beech, sugar-maple and tulip tree.

"Sandstone" (Lower Carboniferous).

p. 270. Cap of hill—grassy. p. 255. Cone-top of sandstone fragments—vines, young chestnuts, andropogon, osmunda, near top; grass and copse on top.
p. 258. Hill-caps—chestnut oak.
p. 262. Id. covered with stoneless clay—andromeda, huckleberry, scattered hickory and oak.
p. 266. Hill—plants of sandstone formation, as huckleberry and chestnut.
p. 259. Sandy gravels along sluggish streams—*Nymphæa odorata* which seems not to thrive on limestone.
p. 269. Ascent, mixed with slate—two species of huckleberry.

1st Report: p. 103. (Alluvial mixture) Scioto bottoms, lower—sycamore, cottonwood, black walnut.
Scioto valley sides—general mixture of "western" trees, including locust and paw-paw.

"Conglomerate" (Lower Carboniferous).

2nd Report: p. 131. Topped by oaks or evergreens.
p. 130. Declivities—often covered by evergreens.
(Upper Carboniferous, Pottsville and Alleghany Series).

1st Report: p. 102. (Sand) rock knobs—pine on n. and w. slopes, oak elsewhere.
p. 36. Calcareo-siliceous region—heavy forest of largest trees, esp. chestnut and tulip tree.
(Id., Monongahela & Dunkard Series).
p. 50. Thin, fissile, slaty hard sandstone—only stunted scrub oaks and vines.
p. 49. Light sandy loam on loose sand rock of lofty ridges—chestnut and chestnut oak.
p. 49. Sandy loam on coarse sand rock above limestone and marls—yellow oak, chestnut and tulip tree.
p. 45. Sandy Pomeroy Series, lime, shale, sand mixture—very fertile, heavy forest, sugar maple and beech to tops of hills.
p. 49. Calcareo-argillaceous chocolate colored soils on red shales—present limits yellow pine.
p. 49. Non-fossiliferous limestones and marls—uplands heavy forest, chiefly oaks and hickories containing abundant remains of yellow pine, but only occasional living specimens of same.
p. 50. Limestone residual soil—fertile, alluvial type of forest to tops of hills.

Two facts at least emerge from a study of the above somewhat confusing list of observations. In the first place there appear to have been selective effects exerted by some of the residual soils, which tended to disappear on weathering and in mixtures. In the second place, so far as our evidence goes, the progress of physiographic development was accompanied by a marked trend toward mesophytism upon all of the rocks.

Our next line of evidence is derived from contemporary description of actual successional phenomena upon glaciated country, principally within the Erie Basin. From among a great many observations the following are selected as most illuminating.

In Stark County, near Waynesburg, in Sandy Township, the first settlers saw young oaks coming up everywhere amongst

rank prairie grass (6, a). Read (7, a) in discussing the physiography of Huron County, describes a primitive forest mainly of large oaks growing upon an old swamp consisting of several feet of black mold. He also describes the physiographic history of a filled swamp which he found largely occupied by yellow and swamp oaks. Parts of Tiverton Township, Coshocton County, (6, b) were covered when first settled with a low underbrush of oak over which a wagon could be driven. White oak, accompanied by elm, ash, white thorn, elder and plum, composed the scattering trees of a grassy intervale on the 6th meridian (8, a) between Ashtabula and Geauga counties. The succession on the poorly drained flat between the Miami and Stillwater rivers in Miami County, is described by John Hussey (9) as beginning with sedges, "mosses," etc., followed by elms, soft-maple, buttonbush, etc., leading on to burr oak and ash. The oak openings of Fulton County (6, c) were stabilized dunes, with lagoons occupied by marsh and prairie and the rounded hills showing no tree but oak, and this only in the flatter portions. It is to be noted, however, that with settlement and the discontinuance of Indian fires, the growth of oak became very dense in parts of the oak openings, instead of sparse as theretofore, while aspen appeared in some of the drier prairies, (10, b).

The first surveyors of Mahoning County encountered, 3rd Merid., 10th Mi., (8, b) a soil "of a hard pale coloured marle or clay & * * smart to taste * * the Timber * * White Oak, Hickory & * * various kinds of Whortles." Oak-chestnut covered the hills of Portage (11) and Coshocton (6, b) counties, while on the clay uplands of Greene County (12, a) and the cold, poorly drained till of Madison County (12, b), there was little timber beside oak. In the latter county this consisted of *Quercus palustris*, *Q. obtusiloba* and *Q. alba;* on somewhat better land—clay over gravel—bur oak was found, while the upland gravel "points" of Greene County bore black walnut, sugar, blue ash, and hickory in contrast to the oak of the surrounding clay. The heavy clay moraine near Defiance (13) was covered by oak woods with hazel undergrowth. Adjacent was a French and Indian cornfield of over 1,000 acres. This field is called a prairie by Spencer, who was a captive among the Indians, but elsewhere is spoken of as a clearing. In the first survey of Trumbull County, (8, b) 3rd Merid., 13th Mi., the following notes were recorded "water, but does not run * * thicket [of vines & briers & willows, small popples, thorns, crabtree,

cherry, oak * * spots of grass, Angelica & Golden Rod] soil excellent * * some Hazle bushes * * also now and then a stately White Oak which escaped the fire, the cause of the thicket * * to a ridge of White Oak."

Turning next to stages of succession beyond the oak, the first reconnaissance of Medina County (8, c) noted as remarkable the absence of beech in the eastern half of Tp. No. 4 N., R. 13 W. The other timber here was linden, hickory, black oak, chestnut, and cucumber. The western half of this township, which even on modern maps is clearly more mature physiographically than the eastern, contained beech, sugar-maple, chestnut, and hickory. Fulton Township, Fulton County, (6, c) in its primitive state was covered with a heavy growth of timber consisting of white oak, some red oak, elm, ash, and a large amount of cottonwood, interspersed with tulip tree and some linden. Beyond the grassy intervale between Trumbull and Geauga counties, already referred to in the preceding paragraph, lay gently rising land with many small white pines growing amongst oak and ironwood. In Portage County (11) when the white man came the juvenile topography of the hills was occupied by oak-chestnut and that of the depressions by ponds and bogs, while the relatively more mature topography of the level lands was covered by beech-sugar maple forest. The whole tract now covered by Cleveland (6, d) was a sandy loam, covered with a mixture of chestnuts, oaks, elms, maples, and beeches with large trunks. In Lorain County, Tp. 2 N., R. 18 W. on soil of good quality T. Kirtland (8, c) and his associates found in the eastern part "large Oak and small Timber Beech Sugar tree and here it is appearent that the kinds of Timber have been shifting for considerable time."

Having thus some contemporary evidence that oak forest, xerarch or hydrarch was eventually being succeeded by beech-sugar maple mesophytic, it is interesting to examine some records which throw light on the purely hydrarch forest succession. In Tp. 4 N., R. 18 W., Lorain County, (8, c) the forest was beech-sugar maple, mixed with ash, elm, and linden, but on the so-called "scalded" patches of land the trees were sycamore, black ash, and white ash. In the same county and township but in R. 16, (8, c) the forest was scalded beech-sugar maple, with black and white ash "remarkably straight and tall." In Portage County, 7th Merid., Tp. 4 N. (8, d) was found a willow swamp, adjoined by ash land, cold, wet, and plain.

The timber here was black ash, birch, maple, beech, and some swamp oak. Howe (13) in giving an account of the Black Swamp as found in Henry County, describes the dense and uniform growth of forest-trees, "among which beech, ash, elm, and oak, cotton-wood and poplar most abound." He also states that the limestone ridges running through the swamp were covered with black walnut, butternut, red elm, and maple, while flood plain species occupied the gravel ridge at Van Wert. Riddell (4) in his brief mention of the Black Swamp as he saw it in Wood, Lucas, and Ottawa counties, notes the fine black soil, underlain by limestone, and describes the forest vegetation as very similar to that on the level tracts of the Scioto and Miami rivers. Oaks, hickories, black walnut, and cottonwood seemed to him especially abundant.

In the 22nd Mi. of the 6th Merid., between Trumbull and Portage Counties (8, a) was a swamp of willow, alder, maple, ash, and gray birch, with low beech ridges. Read (7, b) in discussing the filled valleys of Knox County states that they had so much gravel that walnut and maple was the usual growth instead of [oak and prairie] as in the clay-filled valleys. The surface soil of Wayne County, (6, c) was pronounced friable, except in the beech and marshy districts. Where the 6th Merid. was run between what are now Ashtabula and Geauga Counties (38th Mi. N.) Pease (8, a) observes "besides Alders and swampy shrubs there is Elm, Butternut, and Ash Staddles and they appear to be the first of the kind ever produced here. The Alders are the largest I ever saw and are by far the biggest Timber in the Swamp it is not a miry place the horses passed it loaded * * * [beyond] is grass and Solandine * * * the upland is gently rising good land * * * Timber, Maple, Beech, Oak, Cherry, Bass, Elm, and Ironwood." Read (7, c) in his geological report on Lake County, states that the dense forests of elm and black ash found in places in the northern part of Willoughby and Mentor Townships indicate areas long occupied by shore swamps.

There is little doubt that wooded swamps, even those containing alder and birch, were passing through a succession involving ash, or at times, oak, as prominent genera. The latter stages in turn were succeeded by a mesophytic forest in which beech and sugar maple were conspicuous. Such seems to have been the genesis of the wet beech flats in northeastern Ohio and the general tendency of the more fertile Black

Swamp of the northwestern region. What factors favored oak swamp forest as against ash is not clear. There is some reason to regard water relations as the key, the oak swamp being, perhaps, more resistant to summer drought. Species of oak

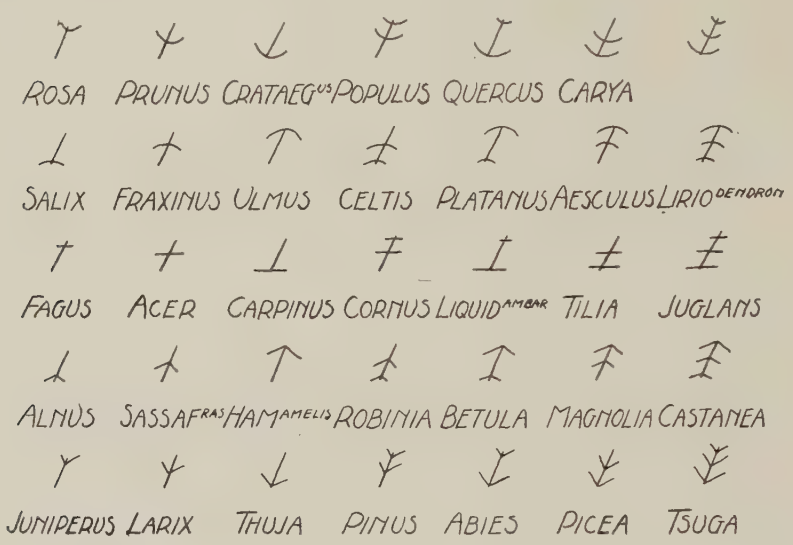
ROSA PRUNUS CRATAEGUS POPULUS QUERCUS CARYA
SALIX FRAXINUS ULMUS CELTIS PLATANUS AESCULUS LIRIODENDRON
FAGUS ACER CARPINUS CORNUS LIQUIDAMBAR TILIA JUGLANS
ALNUS SASSAFRAS HAMAMELIS ROBINIA BETULA MAGNOLIA CASTANEA
JUNIPERUS LARIX THUJA PINUS ABIES PICEA TSUGA
P. VIRGINIANA. Q. ALBA. Q. FALCATA. Q. MACROCARPA.
Q. MARILANDICA. Q. PALUSTRE. Q. RUBRA. SWAMP OAK?
F. AMERICANA. F. NIGRA. U. AMERICANA. U. FULVA.
A. SACCHARUM. A. RUBRUM. OSTRYA SP. J. NIGRA.
J. CINEREA. GLEDITSIA SP

Figure 2.

Key to mapping symbols used. Above, generic symbols; below, species or special genera.

were numerous and included a fair range of physiological types, but we must agree with Gleason (14, a) that the genus is relatively immobile. Certainly the relation of swamps to adjacent forest, rodent ecology, germination requirements, and rooting habits must all have been elements in the problem.

Mention should be made of an observation recorded by Lesquereux (15) who states that swamp rose and buttonbush require rotten logs for the germination of their seeds in swamps, the roots then penetrating the soil during the dry season and becoming established. This may give a valuable clue to the puzzling fact that some swamps remained herbaceous

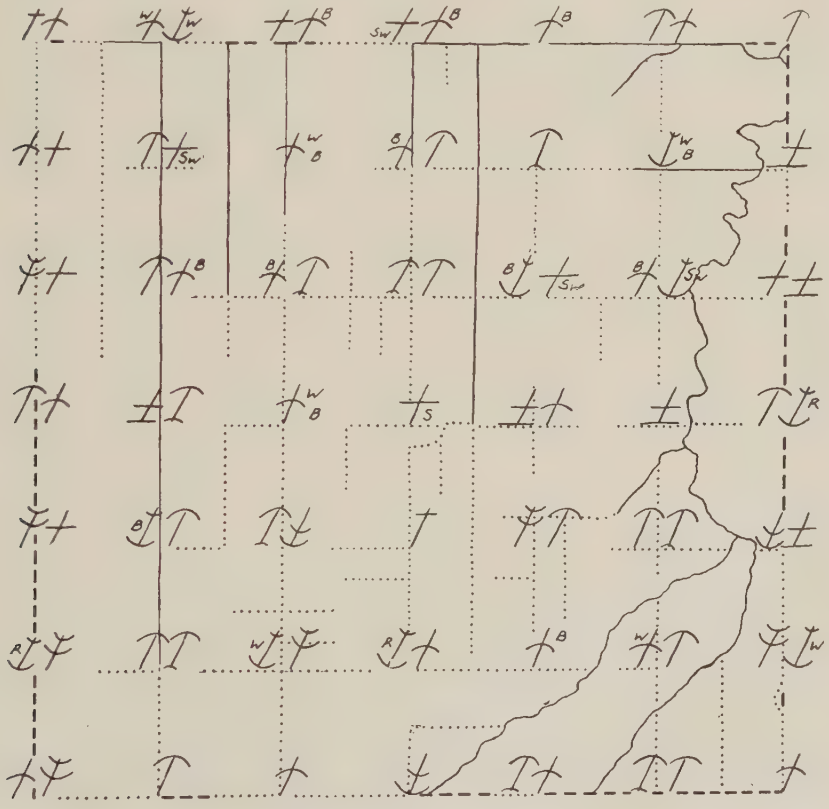

Figure 3.

Present drainage and original forest of Tp. 4 N., R. 8 E., Henry Co. Forest an advanced stage of the ash-elm-maple-cottonwood association; topography youthful, as the rectangular ditches indicate.

indefinitely, while others seemingly much like them, became wooded very rapidly.

The early records contain substantial evidence that land subsidence, beavers, and Indian culture all have had marked effect on successional history. One cannot spend many years on the problems of Ohio vegetation without becoming con-

vinced of the profound importance of a better knowledge than we now have concerning ethnological factors and reactions.

Coming now to the detailed forest map of Ohio (1) based upon the bearing trees at one-mile intervals, what information does it supply with respect to natural succession? The general morainal relation of Oak, Beech, and Ash types as pointed out

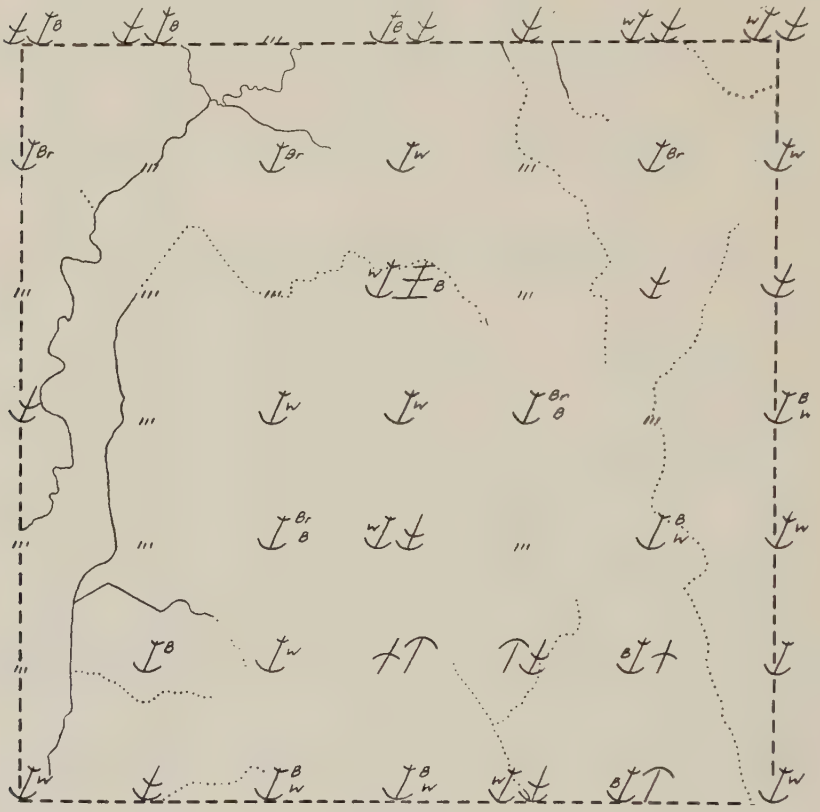

Figure 4.

Present drainage and original forest of Tp. 5 S., R. 15 E., Marion Co. Vegetation white oak-black oak, bur oak, hickory, prairie; topography youthful.

in Part I certainly suggests that the mesophytic Beech occupies the most mature region physiographically of the three.

In Fig. 2 are reproduced as a key to the figures following the mapping symbols used to designate various species of trees transcribed from original survey records. Fig. 3 represents Tp. 4 N. R. 8 E. in Henry County, surveyed in 1821, (16),

showing the species of bearing trees at section corners at that time. The drainage is mapped as shown on the McClure Sheet, done in 1906–7 (17). Most of this drainage it will be noted, consists of rectangular ditches made since the region was settled. The forest cover is typical for the Black Swamp region, consisting largely of white and black ash, elm, maple, cottonwood,

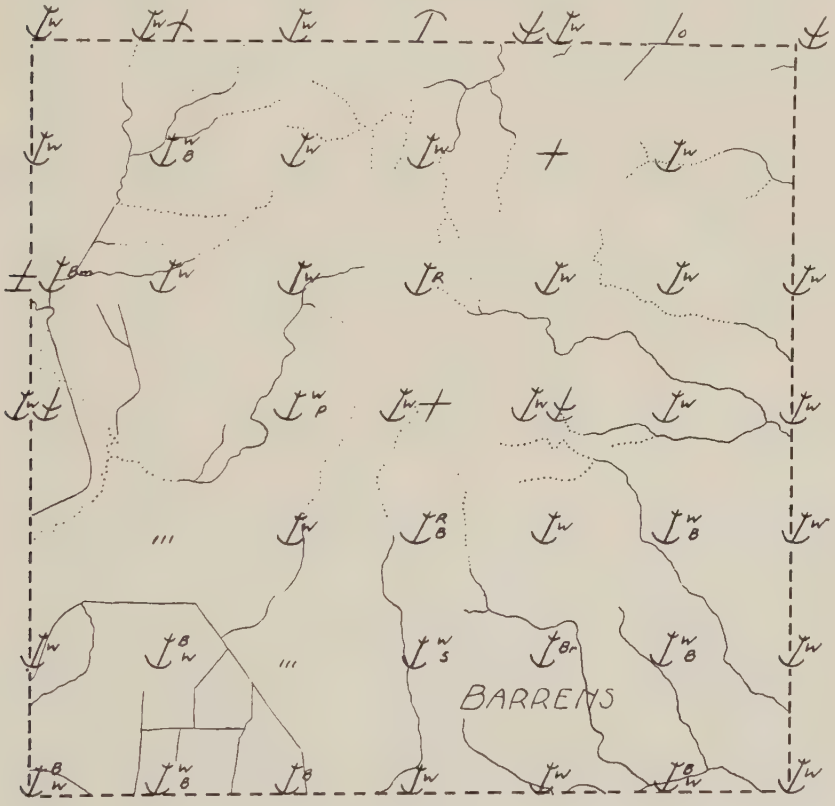

Figure 5.

Present drainage and original forest of Tp. 9 N., R. 14 W., Wayne Co. Forest mostly oak, black and white; artificial ditches and centrifugal stream heads indicate youthful topography.

with some oak and hickory, and even the more mesophytic linden, tulip tree, and beech in places. The extensive ditching indicates clearly enough the youthful physiographic character of this forest association.

The Oak group of associations is represented in two of its phases in Figs. 4 and 5. Fig. 4 records the trees present in

Tp. 5 S., R. 15 E. of Marion County (16) when originally surveyed, (about 1810). Black oak-white oak, bur oak, hickory, and prairie are conspicuous. The drainage was mapped about 95 years later, in 1905 on the Marion Sheet (17). It is known to be much more extensive than formerly (1, II), but is obviously still far from mature. The other area, Tp. 19 N.

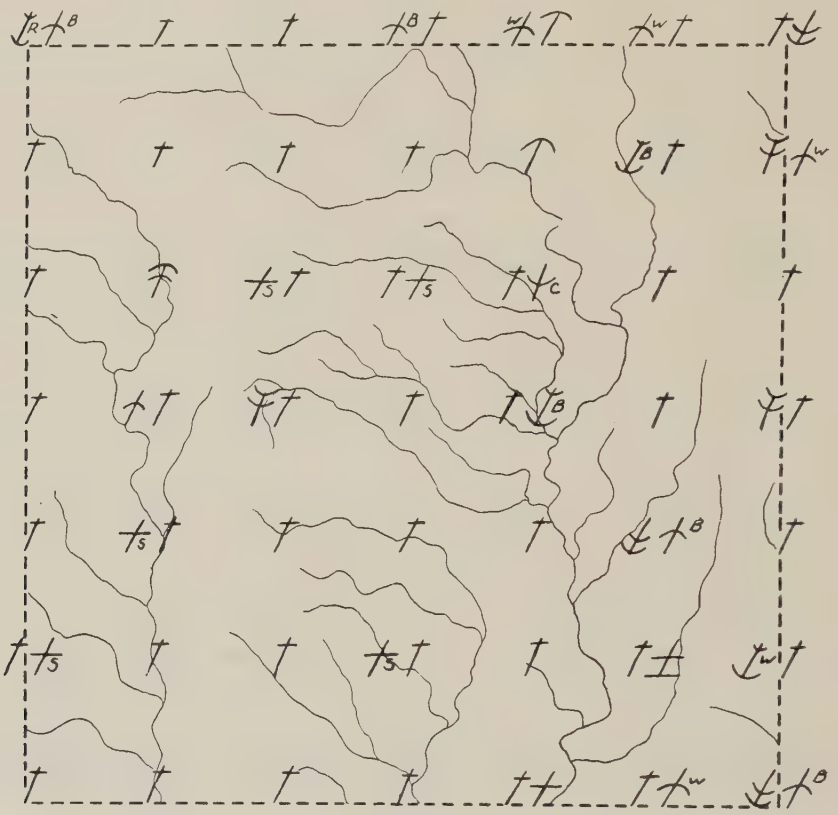

Figure 6.

Present drainage and original forest of Tp. 2 S., R. 11 E., Hancock Co. Beech-sugar maple association, drainage pattern fairly uniform and mature.

R. 14 W. of Wayne County (8, b) was predominantly white oak and black oak (16). Seemingly well drained, it is actually quite youthful physiographically, as the diverging stream heads and the ditches at the western and southwestern edge bear witness (West Salem Sheet, 17). The trees were recorded here in 1807, the drainage between 1905 and 1912.

From among a number of typical areas of beech-maple forest two have been selected, quite at random. Fig. 6 represents the virgin forest and the modern drainage of Tp. 2 S. R. 11 E. of Hancock County (16) (Arlington Sheet, 17), and Fig. 7, the same for Tp. 7 N. R. 2 E. of Preble County (16) (Oxford Sheet, 17). In both the trees are predominantly

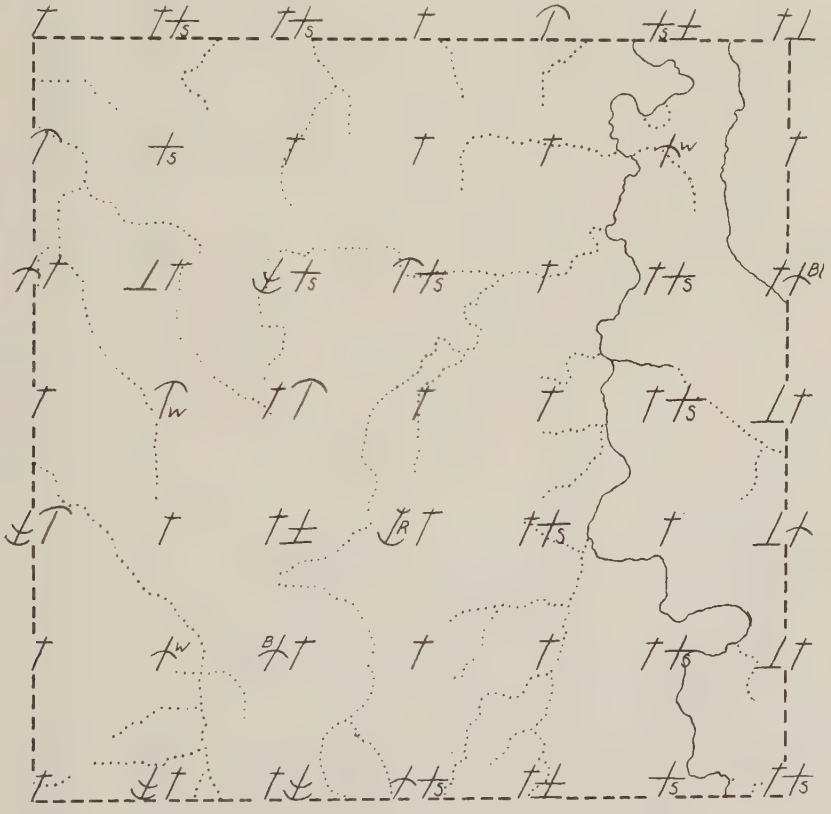

Figure 7.

Present drainage and original forest of Tp. 7 N., R. 2 E., Preble Co. Beech-sugar maple association, drainage well developed.

beech and sugar maple, with more or less admixture of oak, ash, hickory, and linden. A glance is sufficient to establish the relative maturity of the physiography of both as indicated by the drainage.

Since there naturally are objections to comparing modern drainage with vegetation of one hundred years ago, Figs. 8

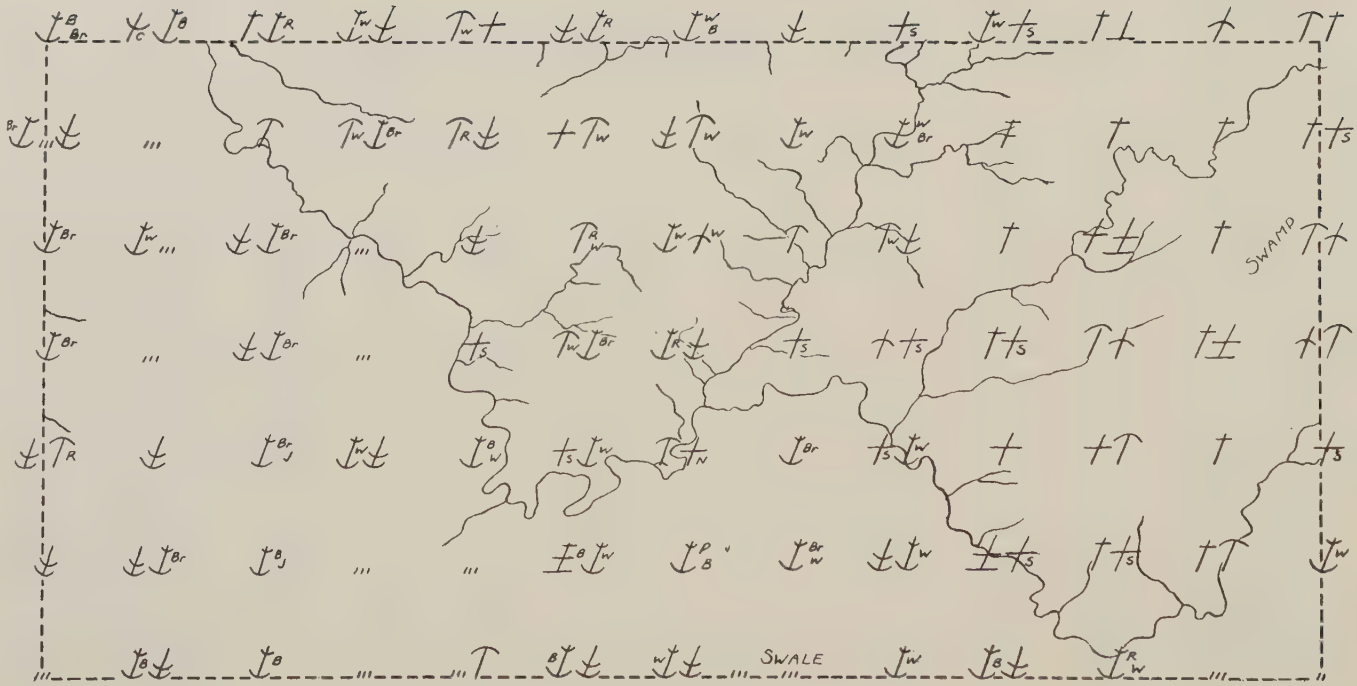

Figure 8.

Original drainage and forest of Tps. 3 S., Rs. 14 and 15 E., Wyandot and Crawford Counties. Organized drainage almost nil in prairie-oak-hickory mixture at bottom and left; better in transition zone of upper center; best in beech-maple at right.

and 9 of Tp. 3 S., Rs. 14 and 15 E. in Wyandot and Crawford counties are of interest. In Fig. 8 is represented not only the forest but also the drainage as mapped in 1819, about 10 years after the original survey (16) (18). The absence of any organized drainage whatsoever in the prairie-oak-hickory area to the south of the Sandusky river is striking, while in the eastern area north of the river, occupied by beech and sugar maple, the drainage is clearly well developed. The triangular patch* in the north center of the map shows drainage somewhat developed and here instead of prairie and oak is elm, maple, and

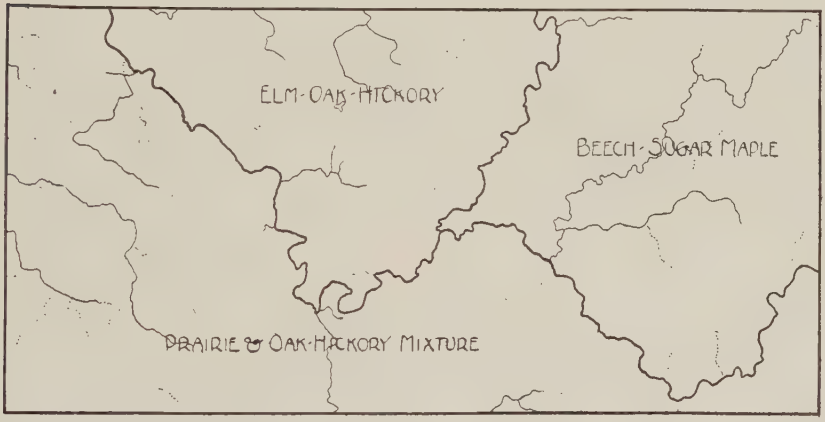

Figure 9.

Same area as Fig. 8, drainage as at present. Note rapid extension of drainage in prairie-oak-hickory region since settlement.

oak. In Fig. 9 is recorded the present drainage of the same area. The most considerable change has been the extension of drainage in the originally undrained prairie-oak-hickory area, tending somewhat to lessen the physiographic contrast between it and the more advanced successional stages. This type of change has occurred rather generally in hydrarch areas, making it all the more remarkable that in every case examined there is still visible a definite correlation between the character of the native vegetation and the degree of physiographic maturity as judged by present conditions.

*Riddell, entering this patch from the west in 1836, describes it as follows (4): "After crossing the Sandusky, we traversed two miles of plain, where the prairie and woodland vegetation contend for mastery. The trees then began to occur more closely together, and we soon had a dense, unbroken forest."

CLIMATIC CONTROL.

In constructing the trend of succession in a given region the broad climatic tendencies are of first importance. What evidence is afforded by the natural vegetation on this point?

1. J. G. Kirtland, a most excellent naturalist, who knew the native fauna and flora of Ohio well (19) pronounced the flora of the southern shore of Lake Erie mainly southern, but with some hyperborean elements. Certainly boreal associations, in the form of bogs, while frequent, were not extensive nor aggressive. For example, none were found within the great hydrarch area last vacated by Lake Erie and enclosed within the ancient shore lines of Lake Whittlesey. This means apparently that such boreal associations have not been initiated within more recent postglacial times. What is more, in a great number of former bog habitats, which give every evidence of having been occupied by boreal subclimax the present vegetation consists of non-boreal successors, e. g., beech and sugar maple.

2. Plants whose centers are westerly, such as *Andropogon furcatus*, *Tilia americana*, *Ostrya virginiana*, *Quercus macrocarpa*, etc., although numerous in northwestern Ohio, are all clearly members of subclimax associations. In this region the bulk of space has for a long time been occupied by subclimax plants and the most active, hence most significant phase of succession climatically is that which leads on to climax associations. As will be seen later, the climax here includes beech and sugar maple, with other forms decidedly more southern than western.

3. In the nonglaciated region of deep relief the most active changes are due to erosion. Aggressive associations would be expected then in the uplands, xerophytic, and predominantly southeastern in their forest cover. Mesophytes of northeasterly origin such as *Tsuga* were largely confined to isolated ravines, long stabilized, and were certainly not as abundant in the natural climax as *Fagus*, *Acer saccharum*, *Magnolia acuminata*, *Liriodendron tulipifera*, etc.

4. Much of central and southwestern glaciated Ohio has been long since covered by subclimax vegetation. Here again the most active phase of succession is from subclimax on.

There is no question that apart from *Acer* and *Fagus* the predominant mesophytes in this portion of Ohio, e. g., *Aesculus*, *Juglans*, *Liriodendron*, etc., have southern and southwestern centers of optimum growth.

5. The behavior above described for western as well as boreal forms suggests a retreat from Ohio—more recent for the western than the boreal. This accords with the general theory of postglacial northward movement of boreal vegetation and with the hypothesis of an ensuing period of continental climate (14, b). If one postulates an Arctic-Labradorean-Manitoban sequence of climate for Ohio this does not seem unreasonable. But a xerothermic hypothesis which assumes Arctic-Labradorean-Coloradoan climates in sequence is harder to follow.

6. Reviewing these five propositions we arrive at a definite suggestion with reference to climatic trend as expressed in natural vegetation between 1798 and 1835. The aggressive phases of natural vegetation in Ohio were southerly in their general character and indicated a continuing northerly trend of southern climate.

SUMMARY.

1. In this third and concluding paper of the series on Natural Vegetation of Ohio the historical method has been extended to an attempt to reconstruct the natural plant successions.

2. Since the data available for this purpose consist largely of the observations of men who perceived the process of succession incompletely or not at all, only the broadest general outlines can be derived.

3. By analyzing and plotting the habitat data of Riddell's Synopsis of the Western Flora the hydrarch sequence of much of glaciated Ohio was found to consist of the following series: Water, Marsh, Wet Meadow, Dry Meadow, Open Woods, and Shady Woods. Bog and Swamp seem to represent restricted offshoots from the main course of succession, at least in Riddell's experience. His data fail to shed light on either the xerarch series or the series involving swamp forest.

4. Tabulation of observations published by the Geological Survey in 1838 confirms the findings of Part I regarding the selective influence of rock beneath residual soils in unglaciated

Ohio. This tabulation also shows progressive mesophytism accompanying physiographic development in unglaciated Ohio.

5. Field observations of the first surveyors and of early naturalists have been studied. They indicate clearly the existence of a trend toward mesophytism in all parts of the state that have been glaciated. In xerarch successions the oaks were conspicuous, accompanied by chestnut on silicious soils. In hydrarch successions, following the wet meadow, ash was conspicuous along with elm and soft maple. Oak frequently played a part in the hydrarch series, but was often lacking. The oak stage in any series yielded to hickory, red oak, linden, sugar maple, and finally beech, to which was added white ash, tulip, and other mesophytes. (In mellower soils, however, such as rich sandy alluvium, or gravelly upland clay, the final mesophytic stage containing beech seems to have been preceded by one in which hickory, sugar maple, black walnut, and tulip tree were prominent). On stiff, wet clay flats, ash swamps were succeeded directly by beech, often in fairly pure stands. Here the other mesophytes made but slow progress, but were not altogether absent.

6. Maps of the original section corner trees showing the present drainage indicate clearly, in spite of the lapse of time, that beech-sugar maple mesophytic forest occupied the most mature ground physiographically, while the subclimax and pioneer associations, such as oak-prairie, black oak-white oak, ash-elm-maple, etc., were found on relatively youthful topography.

7. The climatic trend, as judged by the character of associations actively developing in the native forest, seems to have been in favor of southerly forms.

8. The climax forest seems to have been a modification of beech-sugar maple in the direction of mixed mesophytic forest.

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